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INDOCTI DISCANT, ET AMENT MEMINISSE PERITI.

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ENCYCLOPÆDIA.

LESTOFF, or Leostoff, a town of Suffolk in England, ſeated on the ſea ſhore, 117 miles north-weſt of London. It is concerned in the fiſheries of the North-ſea, cod, herrings, mackerels, and ſprats; has a church, and a diſſenting meeting houſe; and for its ſecurity, ſix eighteen-pounders, which they can move as occaſion requires; but it has no battery. The town conſiſts of 500 houſes; but the ſtreets, though tolerably paved, are narrow. It has a market on Wedneſdays, and two fairs in the year for petty chapmen. The coaſt is there very dangerous for ſtrangers.

L'ESTRANGE (Sir Roger), a noted writer in the 17th century, was deſcended from an ancient family, ſeated at Hunſtanton-hall in the county of Norfolk, where he was born in 1616, being the youngeſt ſon of Sir Hammond L'Eſtrange baronet, a zealous royaliſt. Having in 1644 obtained a commiſſion from King Charles I. for reducing Lynn in Norfolk, then in poſſeſſion of the parliament, his deſign was diſcovered, and his perſon ſeized. He was tried by a court martial at Guildhall in London, and condemned to die as a ſpy; but was reprieved, and continued in Newgate for ſome time. He afterwards went beyond ſea; and in Auguſt 1653 returned to England, where he applied himſelf to the protector Oliver Cromwell, and having once played before him on the baſs-viol, he was by ſome nicknamed *Oliver's fiddler*. Being a man of parts, maſter of an eaſy humorous ſtyle, but withal in narrow circumſtances, he ſet up a newſpaper, under the title of *The Public Intelligencer*, in 1663; but which he laid down, upon the publication of the firſt London gazette in 1665, having been allowed, however, a conſideration by government. Some time after the Popiſh plot, when the Tories began to gain the aſcendancy over the Whigs, he, in a paper called the *Obſervator*, became a zealous champion for the former. He was afterwards knighted, and ſerved in the parliament called by King James II in 1685. But things taking a different turn in that prince's reign, in point of liberty of conſcience, from what moſt people expected, our author's *Obſervators* were diſuſed as not at all ſuiting the times. However, he continued licenſer of the preſs till King William's acceſſion, in whoſe reign he met with ſome trouble as a diſaffected perſon. However, he went to his grave in peace, after he had in a manner ſurvived his intellectuals. He publiſhed a great many political tracts, and tranſlated ſeveral works from the Greek, Latin, and Spaniſh; *viz*. Joſephus's works, Cicero's Offices, Seneca's Morals, Eraſmus's Colloquies, Eſop's Fables, and Bonas's Guide to Eternity. The character of his ſtyle has been variouſly repreſented; his language being obſerved by ſome to be eaſy and humorous, while Mr Gordon ſays, "that his productions are not fit to be read by any who have taſte or good-breeding. They are full of phraſes picked up in the ſtreets, and nothing can be more low or nauſeous."

LESTWEITHEL, a town of Cornwall in England, about 229 miles diſtant from London. It is a well-built town, where are kept the common gaol, the weights and meaſures for the whole ſtannary, and the county courts. It ſtands on the river Foy, which brought up veſſels from Fowey, before it was choaked up with ſand coming from tin-mines, and therefore its once flouriſhing trade is decayed; but it holds the buſhelage of coals, ſalt, malt, and corn, in the town of Fowey, as it does the anchorage in its harbour. It was made a corporation by Richard earl of Cornwall when he was king of the Romans, and has had other charters ſince. It conſiſts of ſeven capital burgeſſes (whereof one is a mayor), and 17 aſſiſtants or common council. It is part of the duchy of Cornwall, to which it pays L. 11: 19: 10 a year for its liberties. Its chief trade is the woollen manufactory. Its church has a ſpire, the only one except that of Helſton in the county. Its market is Friday, and its fairs are three. It firſt returned members to parliament in the 33d of Edward I. They are choſen by their burgeſſes and aſſiſtants. It was anciently the ſhire-town, and the knights of the ſhire are ſtill choſen here.

LETCHLADE, a town of Glouceſterſhire, 90 miles from London, on the borders of Oxfordſhire and Berks, and the great road to Glouceſter; had anciently a nunnery, and a priory of black canons. In this pariſh is Clay-hill. The market is on Tueſday; and it has two fairs. It is ſuppoſed to have been a Roman town: for a plain Roman road runs from hence to Cirenceſter; and by digging in a meadow near it ſome years ago, an old building was diſcovered, ſuppoſed to be a Roman bath, which was 50 feet long, 40 broad, and 4 high, ſupported with 100 brick pillars, curiouſly inlaid with ſtones of divers colours of teſſeraic work. The Leech, the Coln, the Churn, and Iſis, which all riſe in the Cotſwould-hill, join here in one full ſtream, and become one river, called the *Thames*, which begins here to be navigable, and barges take in butter, cheeſe, and other goods, at its quay for London.

LETHARGY, in medicine (from λεθη *oblivion*, and αργια *numbneſs, lazineſs*), a diſeaſe conſiſting of a profound drowſineſs or ſleepineſs, from which the patient can ſcarce be awaked: or, if awaked, he remains ſtupid, without ſenſe or memory, and preſently ſinks again into his former ſleep. See Medicine-*Index*.

Lethargy, in farriery. See there, § 9.

LETHE, in the ancient mythology, one of the rivers of hell, ſignifying oblivion or forgetfulneſs; its waters having, according to poetic fiction, the peculiar quality of making thoſe who drank them forget every thing that was paſt.

LETI (Gregorio), an eminent Italian writer, was deſcended of a family which once made a conſiderable figure at Bologna: Jerom, his father, was page to prince Charles de Medicis; ſerved ſome time in the troops of the grand duke as captain of foot; and ſettling at Milan, married there in 1628. He was afterward governor of Almantea in Calabria, and died at Salerno in 1639. Our author was born at Milan in 1630, ſtudied under the Jeſuits at Coſenza, and was afterwards ſent by an uncle to Rome, who would have him enter into the church; but he being averſe to it, went into Geneva, where he ſtudied the government and the religion there. Thence he went to Lauſanne; and contracting an acquaintance with John Anthony Guerin, an eminent phyſician, lodged at his houſe, made profeſſion of the Calviniſt religion, and married his daughter. He ſettled at Geneva; where he ſpent almoſt twenty years, carrying on a correſpondence with learned men, eſpecially thoſe of Italy. Some conteſts obliged him to leave that city in 1679; upon which he went to France, and then into England, where he was received with great civility by Charles II. who, after his firſt audience, made him a preſent of a thouſand crowns, with a promiſe of the place of hiſtoriographer. He wrote there the Hiſtory of England; but that work not pleaſing the court on account of his too great liberty in writing, he was ordered to leave the kingdom. He went to Amſterdam in 1682, and was honoured with the place of hiſtoriographer to that city. He died ſuddenly in 1701. He was a man of indefatigable application, as the multiplicity of his works ſhow. The principal of theſe are, 1. The univerſal monarchy of Louis XIV. 2. The life of Pope Sixtus V. 3. The life of Philip II. king of Spain. 4. The life of the emperor Charles V. 5. The life of Elizabeth, queen of England. 6. The hiſtory of Oliver Cromwell. 7. The hiſtory of Great Britain, 5 vols 12mo. 8. The hiſtory of Geneva, &c.

LETRIM, a county of Ireland, in the province of Connaught, 44 miles in length and 17 in breadth; bounded on the eaſt and north-eaſt by Cavan and Fermanagh, by Sligo and Roſcommon on the weſt and ſouth-weſt, and by Longford on the eaſt and ſouth-eaſt. It is a hilly country, with rank graſs, which feeds a great number of cattle. The chief town is Letrim, ſeated not far from the river Shannon. It contains 4000 houſes, 21 pariſhes, 5 baronies, 2 boroughs, and ſends 6 members to parliament.

LETTER a character uſed to expreſs one of the ſimple ſounds of the voice; and as the different ſimple ſounds are expreſſed by different letters, theſe, by being differently compounded, become the viſible ſigns or characters of all the modulations and mixtures of ſounds uſed to expreſs our ideas in a regular language; (See LANGUAGE). Thus, as by the help of ſpeech we render our ideas audible; by the aſſiſtance of letters we render them viſible, and by their help we can wrap up our thoughts, and ſend them to the moſt diſtant parts of the earth, and read the tranſactions of different ages. As to the firſt letters, what they were, who firſt invented them, and among what people they were firſt in uſe, there is ſtill room to doubt: Philo attributes this great and noble invention to Abraham; Joſephus, St Irenæus, and others, to Enoch; Bibliander, to Adam; Euſebius, Clemens Alexandrinus, Cornelius Agrippa, and others, to Moſes; Pomponius Mela, Herodian, Rufus Feſtus, Pliny, Lucan, &c. to the Phœnicians; St Cyprian, to Saturn; Tacitus, to the Egyptians; ſome, to the Ethiopians; and others, to the Chineſe: but, with reſpect to theſe laſt, they can never be intitled to this honour, ſince all their characters are the ſigns of words, formed without the uſe of letters; which renders it impoſſible to read and write their language without a vaſt expence of time and trouble; and abſolutely impoſſible to print it by the help of types, or any other manner but by engraving or cutting in wood. See PRINTING.

There have been alſo various conjectures about the different kinds of letters uſed in different languages; thus, according to Crinitus, Moſes invented the Hebrew letters; Abraham, the Syriac and Chaldee; the Phœnicians, thoſe of Attica, brought into Greece by Cadmus, and from thence into Italy by the Pelaſgians; Nicoſtrata, the Roman; Iſis, the Egyptian; and Vulfilas, thoſe of the Goths.

It is probable, that the Egyptian hieroglyphics were the firſt manner of writing: but whether Cadmus and the Phœnicians learned the uſe of letters from the Egyptians, or from their neighbours of Judea or Samaria, is a queſtion; for ſince ſome of the books of the Old Teſtament were then written, they are more likely to have given them the hint, than the hieroglyphics of Egypt. But whereſoever the Phœnicians learned this art, it is generally agreed, that Cadmus the ſon of Agenor firſt brought letters into Greece; whence, in following ages, they ſpread over the reſt of Europe. See ALPHABET and WRITING.

Letters make the firſt part or elements of grammar; an aſſemblage of theſe compoſe ſyllables and words, and theſe compoſe ſentences. The alphabet of every language conſiſts of a number of letters, which ought each to have a different ſound, figure, and uſe. As the difference of articulate ſounds was intended to expreſs the different ideas of the mind, ſo one letter was originally intended to ſignify only one ſound, and not, as at preſent, to expreſs ſometimes one ſound and ſometimes another; which practice has brought a great deal of confuſion into the languages, and rendered the learning of the modern tongues much more difficult than it would otherwiſe have been. This conſideration, together with the deficiency of all the known alphabets, from their wanting ſome letters to expreſs certain ſounds, has occaſioned ſeveral attempts towards an univerſal alphabet, to contain an enumeration of all ſuch ſingle ſounds or letters as are uſed in any language. See ALPHABET.

Grammarians diſtinguiſh letters into vowels, conſonants, mutes, liquids, diphthongs, and characteriſtics. They are likewiſe divided into capital and ſmall letters. They are alſo denominated from the ſhape and turn of the letters; and in writing are diſtinguiſhed into different hands, as round-text, German-text, round hand, Italian, &c. and in printing, into Roman, Italic, and black letter.

The term LETTER, or *Type*, among printers, not only includes the CAPITALS, SMALL CAPITALS, and ſmall letters, but all the points, figures, and other marks caſt and uſed in printing; and alſo the large ornamental letters, cut in wood or metal, which take place of the illumined letters uſed in manuſcripts. The letters uſed in printing are caſt at the ends of ſmall pieces of metal, about three quarters of an inch in length; and the letter being not indented, but raiſed, eaſily gives the impreſſion, when, after being blacked with a glutinous ink, paper is cloſely preſſed upon it. See the articles PRINTING and TYPE. A fount of letters includes ſmall letters, capitals, ſmall capitals, points, figures, ſpaces, &c.; but beſides, they have different kinds of two-line letters, only uſed for titles, and the beginning of books, chapters, &c. See FOUNT.

LETTER is alſo a writing addreſſed and ſent to a perſon. See EPISTLE.

The art of epiſtolary writing, as the late tranſlator of Pliny's Letters has obſerved, was eſteemed by the Romans in the number of liberal and polite accompliſhments; and we find Cicero mentioning with great pleaſure, in ſome of his letters to Atticus, the elegant ſpecimen he had received from his ſon of his genius in this way. It ſeems indeed to have formed part of their education; and, in the opinion of Mr Locke, it well deſerves to have a ſhare in ours. "The writing of letters (as that judicious author obſerves) enters ſo much into all the occaſions of life, that no gentleman can avoid ſhowing himſelf in compoſitions of this kind. Occurrences will daily force him to make this uſe of his pen, which lays open his breeding, his ſenſe, and his abilities, to a ſeverer examination than any oral diſcourſe. It is to be wondered we have ſo few writers in our own language who deſerve to be pointed out as models upon ſuch an occaſion. After having named Sir William Temple, it would perhaps be difficult to add a ſecond. The elegant writer of Cowley's life mentions him as excelling in this uncommon talent; but as that author declares himſelf of opinion, "That letters which paſs between familiar friends, if they are written as they ſhould be, can ſcarce ever be fit to ſee the light," the world is deprived of what no doubt would have been well worth its inſpection. A late diſtinguiſhed genius treats the very attempt as ridiculous, and profeſſes himſelf "a mortal enemy to what they call *a fine letter*." His averſion however was not ſo ſtrong, but he knew how to conquer it when he thought proper; and the letter which cloſes his correſpondence with biſhop Atterbury is, perhaps, the moſt genteel and manly addreſs that ever was penned to a friend in diſgrace. The truth is, a fine letter does not conſiſt in ſaying fine things, but in expreſſing ordinary ones in an uncommon manner. It is the *proprie communia dicere*, the art of giving grace and elegance to familiar occurrences, that conſtitutes the merit of this kind of writing. Mr Gay's letter, concerning the two lovers who were ſtruck dead with the ſame flaſh of lightning, is a maſter-piece of the ſort; and the ſpecimen he has there given of his talents for this ſpecies of compoſition makes it much to be regretted we have not more from the ſame hand.

Of the Style of Epiſtolary Compoſition. Purity in the choice of words, and juſtneſs of conſtruction, joined with perſpicuity, are the chief properties of this ſtyle. Accordingly Cicero ſays; "In writing letters, we make uſe of common words and expreſſions." And Seneca more fully, "I would have my letters to be like my diſcourſes, when we either ſit or walk together, unſtudied and eaſy," And what prudent man, in his common diſcourſe, aims at bright and ſtrong figures, beautiful turns of language, or laboured periods? Nor is it always requiſite to attend to exact order and method. He that is maſter of what he writes, will naturally enough expreſs his thought without perplexity and confuſion; and more than this is ſeldom neceſſary, eſpecially in familiar letters.

Indeed, as the ſubjects of epiſtles are exceedingly various, they will neceſſarily require ſome variety in the manner of expreſſion. If the ſubject be ſomething weighty and momentous, the language ſhould be ſtrong and ſolemn; in things of a lower nature, more free and eaſy; and upon lighter matters, jocoſe and pleaſant. In exhortations. it ought to be lively and vigorous: in conſolations, kind and compaſſionate; and in adviſing, grave and ſerious. In narratives, it ſhould be clear and diſtinct; in requeſts, modeſt; in commendations, friendly; in proſperity cheerful, and mournful in adverſity. In a word, the ſtyle ought to be accommodated to the particular nature of the thing about which it is converſant.

Beſides, the different character of the perſon, to whom the letter is written, requires a like difference in the modes of expreſſion. We do not uſe the ſame language to private perſons, and thoſe in a public ſtation; to ſuperiors, inferiors, and equals. Nor do we expreſs ourſelves alike to old men and young, to the grave and facetious, to courtiers and philoſophers, to our friends and ſtrangers. Superiors are to be addreſſed with reſpect, inferiors with courteſy, and equals with civility; and every one's character, ſtation, and circumſtances in life, with the relation we ſtand in to him, occaſions ſome variety in this reſpect. But when friends and acquaintances correſpond by letters, it carries them into all the freedom and good-humour of converſation; and the nearer it reſembles that, the better, ſince it is deſigned to ſupply the room of it. For when friends cannot enjoy each others company, the next ſatisfaction is to converſe with each other by letters. Indeed, ſometimes greater freedom is uſed in epiſtles, than the ſame perſons would have taken in diſcourſing together; becauſe, as Cicero ſays, "A letter does not bluſh." But ſtill nothing ought to be ſaid in a letter, which, conſidered in itſelf, would not have been fit to ſay in diſcourſe; though modeſty perhaps, or ſome other particular reaſon, might have prevented it. And thus it frequently happens in requeſts, reproofs, and other circumſtances of life. A man can aſk that by writing, which he could not do by words, if preſent; or blame what he thinks amiſs in his friend with greater liberty when abſent, than if they were together. From hence is eaſy to judge of the fitneſs of any expreſſion to ſtand in an epiſtle, only by conſidering, whether the ſame way of ſpeaking would be proper in talking with the ſame perſon. Indeed, this difference may be allowed, that as perſons have more time to think, when they write, than when they ſpeak; a greater accuracy of language may ſometimes be expected in one, than the other. However, this makes no odds as to the kind of ſtyle; for every one would chooſe to ſpeak as correctly as he writes, if he could. And therefore all ſuch words and expreſſions, as are unbecoming in converſation, ſhould be avoided in letters; and a manly ſimplicity free of all affectation, plain, but decent and agreeable, ſhould run through the whole. This is the uſual ſtyle of Cicero's epiſtles, in which the plainneſs and ſimplicity of his diction is accompanied with ſomething ſo pleaſant and engaging, that he keeps up the attention of his reader, without ſuffering him to tire. On the other hand, Pliny's ſtyle is ſuccinct and witty; but generally ſo full of turns and quibbles upon the ſound of words, as apparently to render it more ſtiff and affected than agrees with converſation, or than a man of ſenſe would chooſe in diſcourſe, were it in his power. You may in ſome meaſure judge of Pliny's manner, by one ſhort letter to his friend, which runs thus: "How fare you? As I do in the country? pleaſantly? that is, at leiſure? For which reaſon I do not care to write long letters but to read them; the one as the effect of niceneſs, and the other of idleneſs. For nothing is more idle than your nice folks, or curious than your idle ones. Farewell." Every ſentence here conſiſts of an antitheſis, and a jingle of words, very different from the ſtyle of converſation, and plainly the effect of ſtudy. But this was owing to the age in which he lived, at which time the Roman eloquence was ſunk into puns and an affectation of wit; for he was otherwiſe a man of fine ſenſe and great learning.

LETTER *of Attorney*, in law, is a writing by which one perſon authoriſes another to do ſome lawful act in his ſtead; as to give ſeiſin of lands, to receive debts, ſue a third perſon, &c.

The nature of this inſtrument is to transfer to the perſon to whom it is given, the whole power of the maker, to enable him to accompliſh the act intended to be performed. It is either general or ſpecial: and ſometimes it is made revocable. which is when a bare authority is only given; and ſometimes it it irrevocable, as where debts, &c. are aſſigned from one perſon to another. It is generally held, that the power granted to the attorney muſt be ſtrictly purſued; and that where it is made to three perſons, two cannot execute it. In moſt caſes, the power given by a letter of attorney determines upon the death of the perſon who gave it. No letter of attorney made by any ſeamen, &c. in any ſhip of war, or having letters of marque, or by their executors, &c. in order to empower any perſon to receive any ſhare of prizes or bounty-money, ſhall be valid, unleſs the ſame be made revocable, and for the uſe of ſuch ſeamen, and be ſigned and executed before, and atteſted by, the captain and one other of the ſigning officers of the ſhip, or the mayor or chief magiſtrate of ſome corporation.

LETTER *of Mart* or *Marque*. See MARQUE.

LETTER*s Patent* or *Overt*, are writings ſealed with the great ſeal of England, whereby a man is authoriſed to do, or enjoy any thing, which, of himſelf, he could not do. See PATENT.—They are ſo called by reaſon of their form; as being open, with the ſeal affixed, ready to be ſhown for the confirmation of the authority given by them.

LETTUCE, in botany. See LACTUCA.

LEVANT, in geography, ſignifies any country ſituated to the eaſt of us, or in the eaſtern ſide of any continent or country, or that on which the ſun riſes.

LEVANT, is alſo a name given to the eaſtern part of the Mediterranean ſea, bounded by Natolia or the Leſſer Aſia on the north, by Syria and Paleſtine on the eaſt, by Egypt and Barca on the ſouth, and by the iſlands of Candia and the other parts of the Mediterranean on the weſt.

LEVATOR, in anatomy, a name given to ſeveral muſcles. See ANATOMY, *Table of the Muſcles*.

LEUCA, in antiquity, a geographical meaſure of length in uſe among the later Gauls; which, according to Jornandes, who calls it *leuga*, contained fifteen hundred paces, or one mile and a half. Hence the name of *league*, now reckoned at three miles; in the lower age, called *leuva*.

LEUCADENDRON, in botany: A genus of the monogynia order, belonging to the tetrandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The florets are tripetalous, with one petal of each trifid; the receptacle is a little villous; there is no proper calyx; the antheræ are almoſt coalited.

LEUCADIA, formerly called *Neritis*, a peninſula of Acarnania, (Homer); but afterwards, by cutting through the peninſula, made an iſland, as it is at this day, called *St Maura*.

LEUCAS, (anc. geog.) formerly called *Neritos* and *Neritum*, a town of Leucadia or Leucas; ſituated near a narrow neck of land, or iſthmus, on a hill facing the eaſt and Acarnania: the foot or lower part of the town was a plain lying on the ſea by which Leucadia was divided from Acarnania, (Livy); though Thucydides places Leucas more inward in the iſland, which was joined to the continent by a bridge. It was an illuſtrious city, the capital of Acarnania, and the place of general aſſembly.

LEUCATA, or LEUCATE, (anc. geog.); a promontory of Leucadia according to Strabo, a white rock projecting into the ſea towards Cephalenia, on which ſtood a temple of Apollo ſurnamed *Leucadius*. At his feſtival, which was annually celebrated here, the people were accuſtomed to offer an expiatory ſacrifice to the god, and to avert on the head of the victim all the calamities with which they might be threatened. For this purpoſe, they made choice of a criminal condemned to die; and leading him to the brink of the promontory, precipitated him into the ſea amidſt the loud ſhouts of the ſpectators. The criminal, however, ſeldom periſhed in the water: for it was the cuſtom to cover him with feathers, and to faſten birds to his body, which by ſpreading their wings might ſerve to break his fall. No ſooner did he touch the ſea, than a number of boats ſtationed for the purpoſe flew to his aſſiſtance, and drew him out; and after being thus ſaved, he was baniſhed for ever from the territory of Leucadia. (*Strabo*, lib. 10. p. 452.)

According to ancient authors, a ſtrange opinion concerning this promontory prevailed for ſome time among the Greeks. They imagined that the leap of Leucata was a potent remedy againſt the violence of love. Hence diſappointed or deſpairing lovers, it is ſaid, were often known to have come to Leucadia; and, having aſcended the promontory, offered ſacrifices

fices in the temple, and engaged by a formal vow to perform the deſperate act, to have voluntarily precipitated themſelves into the ſea. Some are reported to have recovered from the effects of the fall; and among others mention is made § of a citizen of Buthroton, in Epirus, whoſe paſſions, always taking fire at new objects, he four times had recourſe to the ſame remedy, and always with the ſame ſucceſs. As thoſe who made the trial, however, ſeldom took any precaution to render their fall leſs rapid, they were generally deſtroyed; and women often fell victims to this act of deſperation.—At Leucata was ſhown the tomb of Artemiſia; that celebrated queen of Caria who gave ſo many proofs of courage at the battle of Salamis †. Inflamed with a violent paſſion for a young man who inflexibly refuſed her love, ſhe ſurpriſed him in his ſleep and put out his eyes. Regret and deſpair ſoon brought her to Leucata, where ſhe periſhed in the waves notwithſtanding every effort to ſave her ‡. Such likewiſe was the end of the unhappy Sappho. Forſaken by her lover Phaon, ſhe came hither to ſeek relief from her ſufferings, and found her death. (*Menand. ap. Strab.* lib. 10. p. 452.

LEUCIPPUS, a celebrated Greek philoſopher and mathematician; firſt author of the famous ſyſtem of atoms and vacuums, and of the hypotheſis of forms ſince attributed to the moderns. He flouriſhed about 428 B. C.

LEUCOGÆUS, (anc. geog.), a hill ſituated between Puteoli and Neapolis in Campania, abounding in ſulphur; now *l'Alumera*. Whence there were alſo ſprings called *Leucogæi fontes*; the waters of which, according to Pliny, gave a firmneſs to the teeth, clearneſs to the eyes, and proved a cure in wounds.

LEUCOJUM, Great Snow-drop: a genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the ninth order, *Spathaceæ*. The corolla is campanulated, ſexpartite, the ſegments increaſed at the points, the ſtigma ſimple.

Species. 1. The vernum, or ſpring leucojum, has an oblong bulbous root, ſending up ſeveral flat leaves ſix or eight inches long, and amidſt them an upright, channelled, hollow, naked ſtalk, about a foot high, terminated by a ſpatha, protruding one or two white flowers on ſlender footſtalks drooping downwards, and appearing in March. 2. The æſtivum, or ſummer leucojum, has a large, oblong, bulbous root, crowned with ſeveral long flat broad leaves; and amidſt them an upright thick, hollow ſtalk, 15 or 18 inches high; terminated by a ſpatha, protruding many white flowers, on ſlender footſtalks, drooping downwards; flowering in May. 3. the autumnale, or autumnal leucojum, hath a large oblong bulbous root, crowned with many narrow leaves, an upright, naked, hollow ſtalk, terminated by a ſpatha protruding many white flowers on long weak footſtalks, hanging downwards, and flowering in autumn.

Culture. All the three ſpecies are very hardy, durable in root, and increaſe exceedingly by offsets, which may be ſeparated every two or three years.

LEUCOMA, in antiquity, was a public regiſter amongſt the Athenians; in which were inſerted the names of all the citizens, as ſoon as they were of age to enter upon their paternal inheritance.

Leucoma, in ſurgery, a diſtemper of the eye, otherwiſe called *albugo*. See Albugo, and Surgery.

LEUCOPETRA, (anc. geog.) ſo called from its white colour (Strabo); a promontory of the Bruttii, in the territory of Rhegium: the termination of the Apennine. The outmoſt extremity of the Bruttii, or the modern *Calabria Ultra*; as the Japygium is of the ancient Calabria, or the modern Calabria Citra.

LEUCOPETRIANS, in eccleſiaſtical hiſtory, the name of a fanatical ſect which ſprang up in the Greek and Eaſtern churches towards the cloſe of the 12th century; the fanatics of this denomination profeſſed to believe in a double trinity, rejected wedlock, abſtained from fleſh; treated with the utmoſt contempt the ſacraments of Baptiſm and the Lord's Supper, and all the various branches of external worſhip; placed the eſſence of religion in internal prayer alone, and maintained, as it is ſaid, that an evil being, or genius, dwelt in the breaſt of every mortal, and could be expelled from thence by no other method than by perpetual ſupplication to the Supreme Being. The founder of this enthuſiaſtical ſect is ſaid to have been a perſon called *Leucopetrus*, and his chief diſciple Tychius, who corrupted by fanatical interpretations, ſeveral books of ſcripture, and particularly St Matthew's goſpel.

LEUCOPHLEGMATIA, in medicine, a kind of dropſy, otherwiſe called *anaſarca*. See (*Index* ſubjoined to) Medicine.

LEUCOTHOE, or Leucothea (fab. hiſt.), the wife of Athamus, changed into a ſea deity; ſee Ino. She was called *Matuta* by the Romans. She had a temple at Rome, where all the people, particularly women, offered vows for their brother's children. They did not intreat the deity to protect their own children, becauſe Ino had been unfortunate in hers. No female ſlaves were permitted to enter the temple; or if their curioſity tempted them to tranſgreſs this rule, they were beaten with the greateſt ſeverity. To this ſupplicating for other people's children, Ovid alludes in theſe lines;

> *Non tamen hanc pro ſtirpe ſua pia mater adorat,*
> *Ipſa parum felix viſa fuiſſe parens.* Faſt. 6.

LEUCTRA, (anc. geog.), a town of Bœotia, to the weſt of Thebes, or lying between Plateæ and Theſpiæ, where the Lacedemonians had a great defeat given them by Epaminondas and Pelopidas the Theban generals. The Theban army conſiſted at moſt but of 6000 men, where as that of the enemy was at leaſt thrice that number: but Epaminondas truſted moſt in his horſe, wherein he had much the advantage, both in their quality and good management; the reſt he endeavoured to ſupply by the diſpoſition of his men, and the vigour of the attack. He even refuſed to ſuffer any to ſerve under him in the engagement, but ſuch as he knew to be fully reſolved to conquer or die. He put himſelf at the head of the left wing, oppoſite to Cleombrotus king of Sparta, and placed the main ſtreſs of the battle there: righly concluding, that if he could break the body of the Spartans, which was but 12 men deep, whereas his own was 50, the reſt would be ſoon put to flight. He cloſed his own with the ſacred band, which was commanded by Pelopidas; and placed his horſe in the front. His right, from which he had drawn ſo many men, he ordered to fall

back,

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§ *Ptolem. Hephæſt. ap. Phot.* p. 491.

† *Herodot* lib. 8. cap 87.

‡ *Ptolem. Hephæſt.* ibid.

back, in a ſlanting line, as if they declined to fight, that they might not be too much expoſed to the enemy, and might ſerve him for a corps of reſerve in caſe of need. This was the wiſe diſpoſition which the two Theban generals made of their few but reſolute forces; and which ſucceeded in every part, according to their wiſh. Epaminondas advanced with his left wing, extending it obliquely, in order to draw the enemy's right from the main body; and Pelopidas charged them with ſuch deſperate ſpeed and fury, at the head of his battalion, before they could reunite, that their horſe, not being able to ſtand the ſhock, were forced back upon their infantry, which threw the whole into the greateſt confuſion: ſo that though the Spartans were of all the Greeks the moſt expert in recovering from any ſurpriſe, yet their ſkill on this occaſion either failed them or proved of no effect; for the Thebans, obſerving the dreadful impreſſion they had made on them with their horſe, puſhed furiouſly upon the Spartan king, and opened their way to him with a great ſlaughter.

Upon the death of Cleombrotus, and ſeveral officers of note, the Spartans, according to cuſtom, renewed the fight with double vigour and fury, not ſo much to revenge his death as to recover his body, which was ſuch an eſtabliſhed point of honour as they could not give up without the greateſt diſgrace. But here the Theban general wiſely choſe rather to gratify them in that point, than to hazard the ſucceſs of a ſecond onſet; and left them in poſſeſſion of their king, whilſt he marched ſtraight againſt their other wing, commanded by Archidamus, and conſiſted chiefly of ſuch auxiliaries and allies as had not heartily engaged in the Spartan intereſt: theſe were ſo diſcouraraged by the death of the king and the defeat of that wing, that they betook themſelves to flight, and were preſently after followed by the reſt of the army. The Thebans, however, purſued them ſo cloſely, that they made a ſecond dreadful ſlaughter among them; which completed Epaminondas's victory, who remained maſter of the field, and erected a trophy in memory of it. This was the concluſion of the famed battle of Leuctra, in which the Lacedemonians loſt 4000 men, and the Thebans but 300.

LEVEL, an inſtrument wherewith to draw a line parallel to the horizon, by means of which the true level, or the difference of aſcent or deſcent between ſeveral places, may be found, for conveying water, draining fens, &c.

There are ſeveral inſtruments of different contrivance and matter, invented for the perfection of levelling; all of which, for the practice, may be reduced to the following.

Air-Level, that which ſhows the line of level by means of a bubble of air incloſed with ſome liquor in a glaſs-tube of an indeterminate length and thickneſs, whoſe two ends are hermetically ſealed. When the bubble fixes itſelf at a certain mark, made exactly in the middle of the tube, the plane or ruler werein it is fixed is level. When it is not level, the bubble will riſe to one end. This glaſs-tube may be ſet in another of braſs, having an aperture in the middle, whence the bubble of air may be obſerved. The liquor wherewith the tube is filled is oil of tartar, or aqua ſecunda; theſe not being liable to freeze as common water, nor to rarefaction and condenſation, as ſpirit of wine is. This application of a bubble of air was the invention of Dr Hooke.

There is one of theſe inſtruments made with ſights, being an improvement upon that laſt deſcribed, which, by the addition of more apparatus, becomes more commodious and exact. It conſiſts of an air level, fig. 1. about eight inches long, and ſeven or eight lines in diameter, ſet in a braſs tube, 2, with an aperture in the middle, C. The tubes are carried in a ſtrong ſtraight ruler, a foot long; at whoſe ends are fixed two ſights, 3, 3, exactly perpendicular to the tubes, and of an equal height, having a ſquare hole formed by two fillets of braſs croſſing each other at right angles, in the middle whereof is drilled a very little hole, through which a point on a level with the inſtrument is deſcried. The braſs tube is faſtened on the ruler by means of two ſcrews; one whereof, marked 4, ſerves to raiſe or depreſs the tube at pleaſure, for bringing it towards a level. The top of the ball and ſocket is rivetted to a little ruler that ſprings one end whereof is faſtened with ſcrews to the great ruler, and at the other end has a ſcrew, 5, ſerving to raiſe and depreſs the inſtrument when nearly level.

Plate CCLXX.

The inſtrument juſt deſcribed however, is yet leſs commodious than the following one; becauſe though the holes be ever ſo ſmall, yet they will ſtill take in too great a ſpace to determine the point of level preciſely.

The inſtrument alluded to conſiſts of an air-level, with teleſcope ſights. This level (fig. 2.) is like the laſt; with this difference, that inſtead of plain ſights, it carries a teleſcope to determine exactly a point of level at a good diſtance. The teleſcope is a little braſs-tube about 15 inches long, faſtened on the ſame ruler as the level. At the end of the tube of the teleſcope, marked 1, enters the little tube 1, carrying the eye-glaſs and an hair horizontally placed in the focus of the object-glaſs, 2; which little tube may be drawn out, or puſhed into the great one, for adjuſting the teleſcope to different ſights: at the other end of the teleſcope is placed the object-glaſs. The ſcrew 3, is for raiſing or lowering the little fork, for carrying the hair, and making it agree with the bubble of air when the inſtrument is level; and the ſcrew 4, is for making the bubble of air, D or E, agree with the teleſcope: the whole is fitted to a ball and ſocket. M. Huygens is ſaid to be the firſt inventor of this level which has this advantage, that it may be inverted by turning the ruler and teleſcope half round; and if then the hair cut the ſame point that it did before, the operation is juſt.

It may be obſerved, that one may add a teleſcope to any kind of level, by applying it upon, or parallel to, the baſe or ruler, when there is occaſion to take the level of remote objects.

Dr Deſaguliers contrived an inſtrument by which the difference of level of two places, which could not be taken in leſs than four or five days with the beſt teleſcope-levels, may be taken in as few hours. The inſtrument is as follows. To the ball C (fig. 3.) is joined a recurve tube B A, with a very fine bore, and a ſmall bubble at top A, whoſe upper part is open. It is evident from the make of this inſtrument, that if it be inclined in carrying, no prejudice will be done to the liquor, which will always be right both in the ball and tube when the inſtrument is ſet upright. If the air at C be ſo expanded with heat, as to drive the liquor to the top of the tube, the cavity A will receive the liquor, which will come down again and ſettle at D, or near it, according to the level of the place where the inſtrument is, as ſoon as the air at C returns to the ſame temperament as to heat and cold. To preſerve the ſame degree of heat, when the different obſervations are made, the machine is fixed in a tin veſſel, EF, filled with water up to *g h*, above the ball, and a very ſenſible thermometer has alſo its ball under water, that one may obſerve the liquor at D, in each experiment, when the thermometer ſtands at the ſame height as before. The water is poured out when the inſtrument is carried; which one may do conveniently by means of the wooden frame, which is ſet upright by the three ſcrews S, S, S, fig. 4. and a line and plummet P P, fig. 5. At the back part of the wooden frame, from the piece at top K, hangs the plummet P, over a braſs point at N; M *m* are brackets to make the upright board K N continue at right angles with the horizontal one at N. Fig. 6. repreſents a front view of the machine, ſuppoſing the fore part of the tin veſſel tranſparent; and here the braſs-ſocket of the recurve-tube, into which the ball is ſcrewed, has two wings at I I, fixed to the bottom, that the ball may not break the tube by its endeavour to emerge when the water is poured in as high as *g h*.

After the Doctor had contrived this machine, he conſidered, that as the tube is of a very ſmall bore, if the liquor ſhould riſe into the ball at A (fig. 3.) in carrying the inſtrument from one place to another, ſome of it would adhere to the ſides or the ball A, and upon its deſcent in making the experiment, ſo much might be left behind, that the liquor would not be high enough at D to ſhow the difference of the level: therefore, to prevent that inconveniency, he contrived a blank ſcrew, to ſhut up the hole at A, as ſoon as one experiment is made, that, in carrying the machine, the air in A may balance that in C, ſo that the liquor ſhall not run up and down the tube, whatever degree of heat and cold may act upon the inſtrument, in going from one place to another. Now, becauſe one experiment may be made in the morning, the water may be ſo cold, that when a ſecond experiment is made at noon the water cannot be brought to the ſame degree of cold it had in the morning; therefore, in making the firſt experiment, warm water muſt be mixed with the cold, and when the water has ſtood ſome time, before it comes to be as cold as it is likely to be at the warmeſt part of that day, obſerve and ſet down the degree of the thermometer at which the ſpirit ſtands, and likewiſe the degree of the water in the barometer at D; then ſcrew on the cape at A, pour out the water, and carry the inſtrument to the place whoſe level you would know; then pour in your water, and when the thermometer is come to the ſame degreee as before, open the ſcrew at top, and obſerve the liquor in the barometer.

The Doctor's ſcale for the barometer is ten inches long, and divided into tenths; ſo that ſuch an inſtrument will ſerve for any heights not exceeding ten feet, each tenth of an inch anſwering to a foot in height.

The doctor made no allowance for the decreaſe of denſity in the air, becauſe he did not propoſe this machine for meaſuring mountains (though, with a proper allowance for the decreaſing denſity of the air, it will do very well), but for heights that want to be known in gardens, plantations, and the conveyance of water, where an experiment that anſwers two or three feet in the diſtance of 20 miles, will render this a very uſeful inſtrument.

Artillery Foot-Level is in form of a ſquare, having its two legs or branches of an equal length; at a juncture whereof is a little hole, whence hangs a thread and plummet playing on a perpendicular line in the middle of a quadrant. It is divided into twice 45 degrees from the middle. Fig. 7.

This inſtrument may be uſed on other occaſions, by placing the ends of its two branches on a plane; for when the thread plays perpendicularly over the middle diviſion of the quadrant, that plane is aſſuredly level. To uſe it in gunnery, place the two ends on the piece of artillery, which you may raiſe to any propoſed height, by means of the plummet, whoſe thread will give the degree above the level.

Carpenter's and Pavior's Level, conſiſts of a long ruler, in the middle whereof is fitted, at right angles, another ſomewhat bigger, at the top of which is faſtened a line, which, when it hangs over a fiducial line at right angles with the baſe, ſhows that the ſaid baſe is horizontal. Sometimes this level is all of one board. Fig. 8.

Gunner's Level, for levelling cannons and mortars, conſiſts of a triangular braſs plate, about four inches high, fig. 9. at the bottom of which is a portion of a circle, divided into 45 degrees; which number is ſufficient for the higheſt elevation of cannons and mortars, and for giving ſhot the greateſt range: on the centre of this ſegment of a circle is ſcrewed a piece of braſs, by means of which it may be fixed or ſcrewed at pleaſure; the end of this piece of braſs is made ſo as to ſerve for a plummet and index, in order to ſhow the different degrees of elevation of pieces of artillery. This inſtrument has alſo a braſs foot, to ſet upon cannons or mortars, ſo as, when thoſe pieces are horizontal, the inſtrument will be perpendicular. The foot of this inſtrument is to be placed on the piece to be elevated, in ſuch a manner, as that the point of the plummet may fall on the proper degree: this is what they call *levelling the piece*.

Maſon's Level, is compoſed of three rules, ſo joined as to form an iſoſceles-rectangle, ſomewhat like a Roman A; at the vertex whereof is faſtened a thread, from which hangs a plummet, that paſſes over a fiducial line, marked in the middle of the baſe, when the thing to which the level is applied is horizontal; but declines from the mark, when the thing is lower on the one ſide than on the other.

Plumb or *Pendulum Level*, that which ſhows the horizontal lines by means of another line perpendicular to that deſcribed by a plummet or pendulum. This inſtrument, fig. 10. conſiſts of two legs or branches, joined together at right angles, whereof that which carries the thread and plummet is about a foot and a half long; the thread is hung towards the top of the branch, at the point 2. The middle of the branch where the thread paſſes is hollow, ſo that it may hang free every where; but towards the bottom, where there is a little blade of ſilver, whereon is drawn a line perpendicular to the teleſcope, the ſaid cavity is covered by two pieces of braſs, making as it were a kind of caſe, leſt the wind ſhould agitate the thread; for which reaſon the ſilver blade is covered with a glaſs G, to the end that it may be ſeen when the thread and plummet play upon the perpendicular: the teleſcope is faſtened to the other branch of the inſtrument, and is about two feet long; having an hair placed horizontally acroſs the focus of the object-glaſs, which determines the point of the level. The teleſcope muſt be fitted at right angles to the perpendicular. It has a ball and ſocket, by which it is faſtened to the foot, and was invented by M. Piccard.

Reflecting Level, that made by means of a pretty long ſurface of water repreſenting the ſame object inverted which we ſee erected by the eye, ſo that the point where theſe two objects appear to meet is on a level with the place where the ſurface of the water is found. This is the invention of M. Mariotte.

There is another reflecting level conſiſting of a mirror of ſteel, or the like, well poliſhed, and placed a little before the object glaſs of a teleſcope, ſuſpended perpendicularly. This mirror muſt make an angle of 45° with the teleſcope, in which caſe the perpendicular line of the ſaid teleſcope is converted into a horizontal line, which is the ſame with the line of level. This is the invention of M. Caſſini.

Water-Level, that which ſhows the horizontal line by means of a ſurface of water or other liquor; founded on this principle, that water always places itſelf level.

The moſt ſimple is made of a long wooden trough or canal, whoſe ſides are parallel to the baſe; ſo that being equally filled with water, its ſurface ſhows the line of level. This is the chorobates of the ancients. See Chorobata.

It is alſo made with two cups fitted to the two ends of a pipe, three or four feet long, about an inch in diameter, by means whereof the water communicates from the one to the other cup; and this pipe being moveable on its ſtand by means of a ball and ſocket, when the two cups become equally full of water, their two ſurfaces mark the line of level.

This inſtrument, inſtead of cups, may alſo be made with two ſhort cylinders of glaſs three or four inches long, faſtened to each extreme of the pipe with wax or maſtic. Into the pipe is poured ſome common or coloured water which ſhows itſelf through the cylinders by means whereof the line of level is determined; the height of the water, with reſpect to the centre of the earth being always the ſame in both cylinders; this level, though very ſimple, is yet very commodious for levelling ſmall diſtances.

Level *of Mr Huygens's invention*, conſiſts of a teleſcope *a*, fig. 11. in form of a cylinder, going through a ferril, in which it is faſtened by the middle. This ferril has two flat branches *bb*, one above, and the other below: at the ends whereof are faſtened little moving pieces, which carry two rings, by one of which the teleſcope is ſuſpended to an hook at the end of the ſcrew 3, and by the other a pretty heavy weight is ſuſpended, in order to keep the teleſcope *in æquilibrio*. This weight hangs in the box 5, which is almoſt filled with linſeed oil, oil of walnuts, or other matter that will not eaſily coagulate, for more aptly ſettling the balance of the weight and teleſcope. The inſtrument carries two teleſcopes cloſe and very parallel to each other; the eye-glaſs of the one being againſt the object glaſs of the other, that one may ſee each way without turning the level. In the focus of the object-glaſs of each teleſcope muſt a little hair be ſtrained horizontally, to be raiſed and lowered as occaſion requires by a little ſcrew. If the tube of the teleſcope be not found level when ſuſpended, a ferril or ring, 4, is put on it, and is to be ſlid along till it fixes to a level. The hook on which the inſtrument is hung is fixed to a flat wooden croſs; at the ends of each arm whereof there is a hook ſerving to keep the teleſcope from too much agitation in uſing or carriage. To the ſaid flat croſs is applied another hollow one, that ſerves as a caſe for the inſtrument; but the two ends are left open, that the teleſcope may be ſecured from the weather and in a condition always to be uſed. The foot of this inſtrument is a round braſs plate, to which are faſtened three braſs ferrils, moveable by means of joints whereon are put ſtaves, and on this foot is placed the box.

Fig. 12. marked I, is a balance-level; which being ſuſpended by the ring, the two ſights, when *in æquilibrio*, will be horizontal, or in a level.

Spirit-Level. The moſt accurate levelling inſtrument, and that poſſeſſed of the greateſt eſſential advantages in uſe, is the ſpirit-level; which was at firſt conſtructed by the late Mr Siſſon, and to which ſome ſmall additions and improvements have been ſince made. The following is a deſcription of one of the beſt of theſe levels, as made by the principal mathematical inſtrument makers.

Fig. 13. is a repreſentation of the inſtrument mounted on its complete ſtaves, copied (except the letters) from Mr Adams's Graphical Eſſays, Plate xvii. fig. 3. The teleſcope (ABC) is made from 15 inches to 2 feet in length, as may be required. It is achromatic, of the beſt kind, and ſhows the objects erect. In the focus of the eye-glaſſes are exceedingly fine croſs wires, the interſection of which is evidently ſhown to be perfectly in the axis of the tube; for by turning it round on its two ſupporters DE, and looking through the teleſcope, the interſection of the wires will conſtantly cut the ſame part of the object viewed. By turning the ſcrew *a* at the ſide of the teleſcope, the object-glaſs at *g* is moved; and thus the teleſcope is exactly adapted to the eye. If theſe croſs wires are at any time out of their adjuſtment, which is diſcovered by their interſection not cutting the ſame part of the object during the revolution of the teleſcope on its axis, they are eaſily adjuſted by means of the four ſcrews *bbbb*, placed on the teleſcope about an inch from the end for the eye. Theſe ſcrews act in perpendicular directions to one another, by unſcrewing one and tightening the other oppoſite to the wire, ſo that if connected with it, it may be moved either way at pleaſure; and in this manner the other wire perpendicular to it may be moved, and thus the interſection of the wires brought exactly in the axis of the tube.

To the teleſcope is fixed, by two ſmall ſcrews *cc*, the level tube containing the ſpirits, with a ſmall bubble of air: This bubble of air, when the inſtrument is well adjuſted, will ſettle exactly in the ſame place, in or near the middle of its tube, whether the teleſcope be reverſed or not on the ſupporters, which in this caſe are kept unmoved.

It is evident that the axis of the teleſcope, or the interſection of the wires as before ſhown, muſt be in this caſe

LEVELS. Plate CCLXX

Fig. 1.

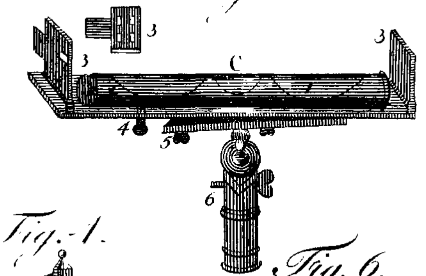


Fig. 2.

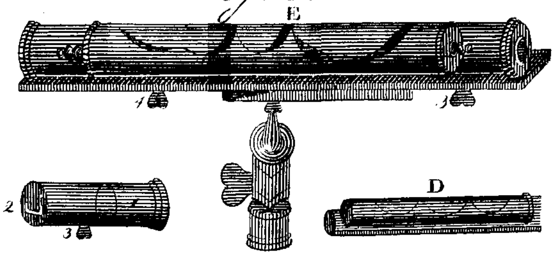


Fig. 3.

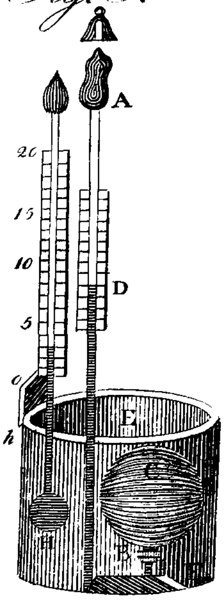


Fig. 4.

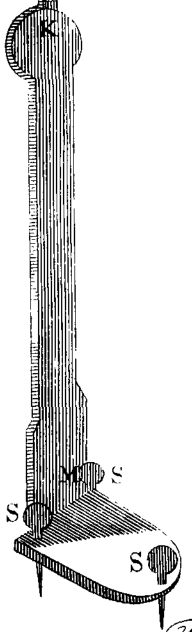


Fig. 6.

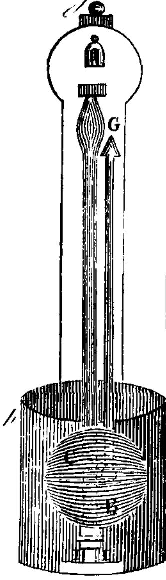


Fig. 14.

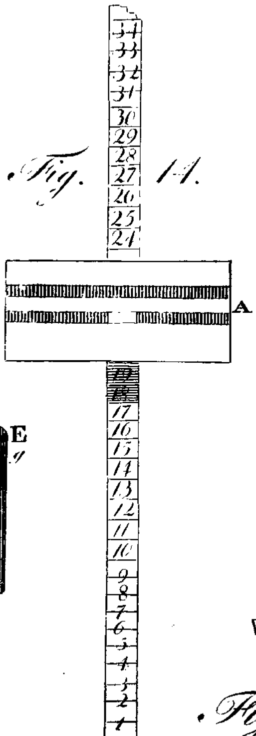


Fig. 5.

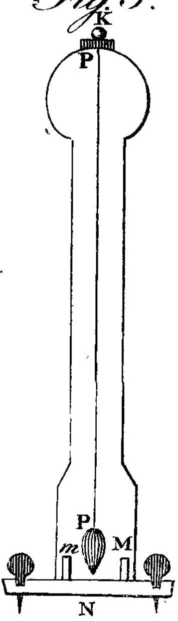


Fig. 9.

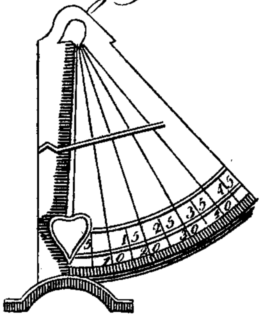


Fig. 8.

Fig. 10.

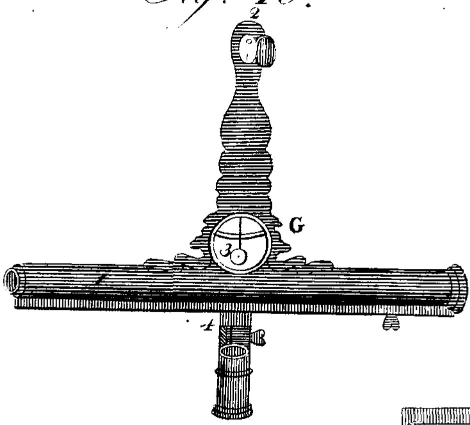


Fig. 13.

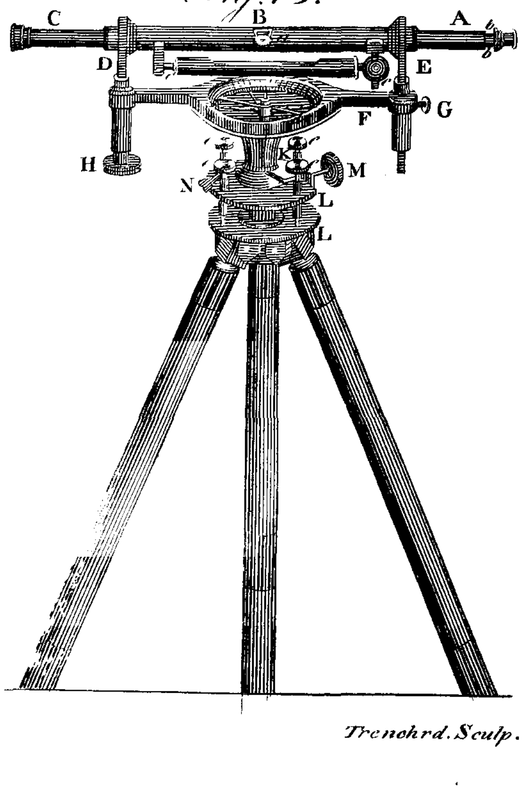


Fig. 7.

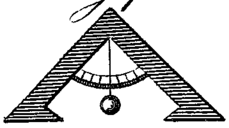


Fig. 11.

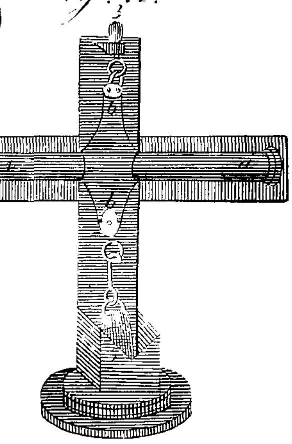
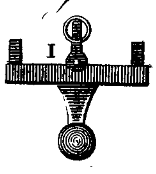


Fig. 12.



Trenchrd. Sculp.

Level.

caſe truly level. In this facile mode of adjuſtment conſiſts the new improvement of the inſtrument; and it is hereby capable of being adjuſted by only one ſtation and one object, which will at the ſame time determine it to be in a true level. If by change of weather, accident, or otherwiſe, the inſtrument ſhould have loſt its level adjuſtment or ſtate, it may thus be readily reſtored and re-adjuſted at the firſt ſtation; which is an advantage none of the inſtruments formerly made have been capable of. The two ſupporters DE, on which the level reſts and turns, are ſhaped like the letter Y. The teleſcope reſts within the upper part of them; and the inner ſides of each of theſe Ys are tangents to the cylindric tube of the teleſcope, which is turned to a true cylinder, and each touches it but at one place only.

The lower end of theſe ſupporters are inſerted into a ſtrong braſs plate (FE), and ſo as to ſtand perpendicularly on it. One is kept faſt by a tightening ſcrew G, and to the other is applied a fine threaded ſcrew H, to adjuſt the tube when on its ſupporters to a true level. To the ſupporter D is ſometimes applied a line of tangents as far as 12 degrees, in order to take an angle of depreſſion or elevation to that extent. Between the ſupporters is alſo ſometimes fixed a compaſs-box I, divided into 360 degrees, and again into four 90°; having a centre pin and needle, and trigger, at *d*, to throw off the needle from the centre when not uſed; ſo in this manner it conſtitutes a perfect circumferenter, connected with all the foregoing improvements. This plate is fixed on a conical braſs ferrel K, which is adapted to the bell-metal fruſtum of a cone at top of the braſs head of the ſtaves, having a ball and ſocket, with three bell-metal joints, two ſtrong braſs parallel plates LL, the four ſcrews *eeee* for adjuſting the horizontal motion, a regulating ſcrew M to this motion, and a faſtening ſcrew N to tighten it on the cone when neceſſary. The faſtening ſcrew N, and the regulating ſcrew M, by which the whole inſtrument is moved with accuracy through a ſmall ſpace in an horizontal direction, was an addition of Mr Ramſden's.

The manner of adjuſting the ſpirit-level at the firſt ſtation.

The whole being now placed ſteadily on its ſtaves, it muſt be rendered parallel to the axis of the teleſcope before you adjuſt the horizontal motion. To this end the teleſcope muſt be placed in a line with two of the ſcrews *ee*, and then levelled thereby till the bubble of air in the ſpirit-tube keeps its poſition in the middle, while turned about two or three points, making nearly right angles at the centre to one another.

The horizontal motion being thus adjuſted, the rims *ff* of the Ys are to be opened, the teleſcope taken off and laid the contrary way upon the ſupporters. If the bubble of air then reſts exactly the ſame, the level and teleſcope are adjuſted rightly to one another; but if the bubble does not remain the ſame, the end to which the air bubble goes muſt be noticed, and the diſtance of it from the teleſcope altered; correcting one half the error by the ſcrews *cc*, and the other half by the ſcrews *ee*.

Now the interſection of the wires being directed to any diſtant object, it may be one of the vanes of the ſtaves hereafter deſcribed: if they continue to be againſt it preciſely while the teleſcope is turned round on its Ys, it proves, as before mentioned, that the axis of the teleſcope coincides with the interſection of the wires, and that the inſtrument will give the true level direction.

Levelling.

The operation of levelling being of a very accurate and important nature, and the beſt inſtrument when out of its adjuſtment being of little uſe, it is quite neceſſary that every perſon uſing ſuch an inſtrument ſhould have it readily in his power to correct it; and the one above deſcribed appears to be the beſt adapted for that purpoſe of any hitherto contrived.

LEVELLING may be defined, the art which inſtructs us in finding how much higher or lower any given point on the ſurface of the earth is than another; or, in other words, the difference in their diſtance from the centre of the earth.

The practice of levelling therefore conſiſts, 1. In finding and marking two or more points that ſhall be in the circumference of a circle whoſe centre is that of the earth. 2. In comparing the points thus found with other points, to aſcertain the difference in their diſtances from the earth's centre.

With regard to the theory of levelling, we muſt obſerve, that a plumb-line, hanging freely in the air, points directly towards the centre of the earth; and a line drawn at right angles, croſſing the direction of the plumb-line, and touching the earth's ſurface, is a true level only in that particular ſpot; but if this line which croſſes the plumb be continued for any conſiderable length, it will riſe above the earth's ſurface, and the apparent level will be above the true one, becauſe the earth is globular; and this riſing will be as the ſquare of the diſtance to which the ſaid right line is produced; that is to ſay, however much it is raiſed above the earth's ſurface at one mile's diſtance, it will riſe four times as much at the diſtance of two miles, nine times at the diſtance of three, &c. This is owing to the globular figure of the earth; and this riſing is the difference betwixt the true and apparent levels; the real curve of the earth being the true level, and the tangent to it the apparent level. Hence it appears, that the leſs diſtance we take betwixt any two ſtations, the truer will be our operations in levelling; and ſo ſoon does the difference betwixt the true and apparent levels become perceptible, that it is neceſſary to make an allowance for it, if the diſtance betwixt the two ſtations exceeds two chains in length. The following is an infallible rule for determining the allowance to be made:

Leach's Inland navigation.

" Multiply the number of Gunter's decimal ſtatute chains that are contained in length between any two ſtations where the levels are to be taken by itſelf, and the product ariſing therefrom again by 124; which is a common multiplier for all manner of diſtances for this purpoſe on account of the earth's curvature: then divide the ſecond product ariſing therefrom by 100,000; or, which is alſo the ſame, with the daſh of the pen cut off five figures on the right hand ſide of the product, and what remains on the left ſide is inches, and the five figures cut off decimal parts of an inch."

The following is *A Table of the Curvature of the Earth*, and ſhows the quantity below the apparent level at the end of every number of chains to 100.

Chains.	Inches.	Chains.	Inches.	Chains.	Inches.	Chains.	Inches.
1	0.00125	14	0.24	27	0.91	40	2.00
2	0.005	15	0.28	28	0.98	45	2.28
3	0.01125	16	0.32	29	1.05	50	3.12
4	0.02	17	0.36	30	1.12	55	3.78
5	0.03	18	0.40	31	1.19	60	4.50
6	0.04	19	0.45	32	1.27	65	5.31
7	0.06	20	0.50	33	1.35	70	6.12
8	0.08	21	0.55	34	1.44	75	7.03
9	0.10	22	0.60	35	1.53	80	8.00
10	0.12	23	0.67	36	1.62	85	9.03
11	0.15	24	0.72	37	1.71	90	10.12
12	0 18	25	0.78	38	1.80	95	11.28
13	0.21	26	0.84	39	1.91	100	12.50

Levelling is either ſimple or compound. The former is when the level points are determined from one ſtation, whether the level be fixed at one of the points or between them. Compound levelling is nothing more than a repetition of many ſimple operations.

An example of ſimple levelling is given Plate CCLXXI. fig. 1. where A B are the ſtation points of the level; C D the two points aſcertained. Let the height

	Feet.	Inches.
From A to C be -	6	0 0
From B to D be -	9	0 0
The difference -	3	0 0

ſhows that B is three feet lower than A.

If the ſtation-points of the level are above the line of ſight, as in fig. 2. and the diſtance from A to C be ſix feet, and from B to D nine feet, the difference will ſtill be three feet which B is higher than A.

As an example of compound levelling, ſuppoſe it were required to know the difference of height between the point A on the river *Zome*, and N on the river *Belann*, fig. 3. (As our author could find no ſatisfactory examples in any Engliſh author, he copied this and the following ones from M. le Febure). In this operation ſtakes ſhould be driven down at A and N, exactly level with the ſurface of the water; and theſe ſtakes ſhould be ſo fixed, that they may not be changed until the whole operation be finiſhed; a plan of the ground between the two rivers ſhould then be made, by which it will be diſcovered, that the ſhorteſt way between the rivers is by the dotted line AC, CH, HN, from whence alſo the number of ſtations neceſſary to be taken will be determined. The operator will alſo be enabled to diſtribute them properly according to the nature and ſituation of the ground. In the figure 12. ſtations are marked. Stakes ought then to be driven in at the limits of each ſtation, as A, B, C, D, &c. They ought to be about two or three inches above the ground, and driven 18 inches into it. Stakes ſhould alſo be driven in at each ſtation of the inſtrument, as 1, 2, 3, 4, &c.

The operation may be begun in the following manner. Let the firſt ſtation be at 1, equally diſtant from the two points A and B, which themſelves are diſtant 166 yards. Write down then in one column the firſt limit A; in another, the number of feet, inches, and tenths; with the points of ſight indicated on the ſtation-ſtaff at A, viz. 7. 6. 0. In the third column, the ſecond limit B; in the fourth, the height indicated at the ſtation-ſtaff B, viz. 6. 0. 0. Laſtly, in the fifth column, the diſtance from one ſtation-ſtaff to the other; which in this caſe is 166 yards. Remove now the level to the point marked 2, which is in the middle between B and C, the two places where the ſtation-ſtaves are to be held; obſerving that B, which was the ſecond limit in the former operation, is the firſt in this. Then write down the obſerved heights as before: in the firſt column B; in the ſecond 4. 6. 0; in the third C; in the fourth 5. 6. 2; in the fifth 560, the diſtance between B and C.

It being impoſſible, on account of the inequality of the ground at the third ſtation, to place the inſtrument in the middle between the two ſtation-ſtaves, find the moſt convenient point as at 3; then meaſure exactly how far this is from each ſtation-ſtaff, and you will find that from 3 to C is 160 yards; from three to D, 80 yards: and the remainder of the operation will be as in the preceding ſtation.

In the fourth operation, we muſt endeavour to compenſate for any error which might have happened in the laſt. Mark out, therefore, 80 yards from the ſtation-ſtaff D to the point 4; and 160 yards from 4 to E; and this muſt be carefully attended to, as by ſuch compenſations the work may be much facilitated. Proceed in the ſame manner with the eight remaining ſtations, obſerving to enter every thing in its proper column; and when the whole is finiſhed, add the ſums of each column together, and then ſubtract the leſſer from the greater; the difference, which in the preſent caſe is 5. 4. 8. ſhows the ground at N to be thus much lower than the ground at A.

To obtain a ſection of this level, draw the dotted line *oo*, fig. 4. either above or below the plan; which may be taken for the level or horizontal line. Let fall then perpendiculars upon this line from all the ſtation-points and places where the ſtation-ſtaves were fixed. Beginning now at A, ſet off 7 feet 6 inches upon the line from A to *a*: for the height of the level-point determined on the ſtaff at this place, draw a line through *a* parallel to the dotted line *oo*, which will cut the third perpendicular at *b*, the ſecond ſtation-ſtaff. Set off from this point downwards ſix feet to B, which ſhows the ſecond limit of the firſt operation; and that the ground at B is one foot ſix inches higher than at A: place your inſtrument between the twe lines at the height of the level line, and trace the ground according to its different heights. Now ſet off on the ſecond ſtation-ſtaff B, four feet ſix inches to C, the height determined by the level at the ſecond ſtation; and from C draw a line parallel to *oo*, which will cut the fifth perpendicular at *d*, the third ſtation-ſtaff. From this point ſet off 5 feet 6 inches $\frac{7}{10}$ downwards to C, which will be our ſecond limit with reſpect to the preceding one and the third with reſpect to the firſt. Then draw your inſtrument in the middle between B and C, and delineate the ground with its inequalities. Proceed

ceed in the ſame manner from ſtation to ſtation, till you arrive at the laſt N, and you will have the profile of the ground over which the level was taken.

This method anſwers very well where only a general profile of the different ſtations is required; but where it is neceſſary to have an exact detail of the ground between the limits, we muſt then go to work more particularly. Suppoſe, therefore, the level to have been taken from A to N by another route, but on more uniform ground, in order to form a canal marked O, P, Q, R, S, T, U, X, Y. Draw at pleaſure a line Z, Y, fig. 5. to repreſent the level, and regulate the reſt; then let fall on this line perpendiculars to repreſent the ſtaves at the limits of each ſtation, taking care that they be fixed accurately at their reſpective diſtances from each other. The difference between the extreme limits, in this caſe, ought to be the ſame as in the former, *viz.* 5 feet 4 inches $\frac{6}{10}$. Set off this meaſure upon the perpendicular *o* the firſt limit; and from *o* prolonging the perpendicular, mark off at *a* the height determined at the firſt ſtation-ſtaff; then do the ſame with the ſecond and third, and ſo on with the following, till this part of the work is finiſhed; there remains then only to delineate in detail the ground between the ſtation-ſtaves, the diſtances in this example being aſſumed larger on account of the detail.

To obtain the ſection of the ground between O and P, place your inſtrument at one of the limits, as P, fixing it ſo that the croſs hairs may anſwer to the point C; then look towards the firſt limit *o*, raiſing or depreſſing the vane till it coincides with the interſection of the croſs hairs; and the line of ſight from one point to the other will mark the level or horizontal line.

To ſet off the height of the brink of the river above the firſt limit, drive a ſtake down cloſe to the ground at *a*; and place your ſtation-ſtaff upon it, obſerving where the hairs interſect the vane, which will be at 4 feet 10 inches; then, laying off upon the line *oz* the diſtance from the firſt to the laſt ſtake, let fall from thence a perpendicular, and ſet off thereon 4. 10. 0 to *a*, which gives the height at the firſt ſtake; or, which is the ſame, the height from the edge of the river above the ſurface of the water, as is evident from the ſection. Drive a ſecond ſtake at 6, in a line between the limits; place the ſtation-ſtaff upon this ſtake, and obſerve the height 4. 6. interſected by the croſs hairs, the inſtrument ſtill remaining in the ſame ſituation. Set off on the level-line the diſtance from the firſt ſtake *a* to the ſecond *b*; and then let fall a perpendicular, and mark upon it 4. 6 to *b*, which gives the height of the ground at this place.

The ſmall hollow *c* is marked out by driving down a third ſtake even with the ground, in the middle of it at *c*; but the exact diſtance of the ſecond ſtake *b* from the third *c*, muſt be marked upon the level line; then let fall a perpendicular from *c*, and ſet off upon it 6. 8. 0, pointed out by the croſs hairs on the ſtaff, which determines the depth of the hollow, as appears from the figure. As the diſtances between the ſtakes are now very ſhort, they can eaſily be marked by the operator, who can ſettle any little inequalities by a compariſon with thoſe already aſcertained. Proceed thus with the other ſtations till you arrive at the laſt, and you will always obtain an accurate ſection of your work; by which it is eaſy to form a juſt eſtimation of the land to be dug away, in order to form the canal, by adding the depth to be given to it.

Fig. 6. gives an example of compound levelling, where the ſituation is ſo ſteep and mountainous, that the ſtaves cannot be placed at equal diſtances from the inſtrument, or where it is even impoſſible to make a reciprocal levelling from one ſtation to the other. Thus ſuppoſe the point K to be the bottom of a baſon where it is required to make a fountain, the reſervoir being at A; ſo that, in order to know the height to which the jet d'eau will riſe, it is neceſſary to know how high the point A is above K.

In great heights ſuch as this, it will be neceſſary to proceed by ſmall deſcents, as from A to D. The inſtrument muſt be adjuſted with all poſſible care; and it will even be proper, in ſome part of the work, to uſe a ſmaller inſtrument. The following is a table of the different operations uſed in making this level, it having been taken from M. le Febure's practice.

	feet.	in.		feet.	in.	yards.
A	21	6	C	0	9	90
C	4	3	D	0	3	40
D	3	9	E	16	3	350
E	5	0	F	17	9	250
F	10	6	G	5	0	375
G	5	0	H	19	0	300
H	5	0	K	47	3	1000
	95	0		106	9	2405

In this caſe only two levellings are made between A and D, though more would have been neceſſary; but they are omitted to avoid confuſion. In the fourth ſtation the height found was 16 feet 8 inches; but on account of the great length, it was requiſite to reduce the apparent level to the true one, which is always neceſſary where the length is conſiderable. At the laſt limit we get the height from N to *o*; then from *o* to I; from I to K, fig. 7. &c. all which added together, and then corrected for the curvature, gives 47 feet 3 inches. Now, by adding each column together, and ſubtracting one from the other, we have 51 feet 9 inches for the height which the point A is above the bottom of the baſon, and which will cauſe the jet d'eau to riſe about 45 feet. The general ſection of this operation is ſhown at fig. 7. 8. but an exact profile of the mountain is more difficult; as requiring many operations; though ſome of theſe might be obtained by meaſuring from the level line without moving the inſtrument.

The laſt example given by our author is likewiſe from M. le Febure, and includes a length of near five German miles (25 of ours) in a ſtraight line, and 9 or 10 (45 or 50 Engliſh) including the turnings and windings. In this the declivity of the river *Haynox* was meaſured from Lignebruk to Villebourg. The firſt operation was to drive ſtakes at ſeveral parts of the river even with the water's edge; the firſt of which a little above the mills of Lignebruk ſhowed the upper water-mark, and another ſhowed the lower water-mark at the ſame mills. Two ſtakes above and below the mills of Mazurance, ſomewhat more than half way between Lignebruk and Villebourg, pointed out

out the difference between high and low water there, and formed likewiſe the third and fourth limit of the operation; while the ſtakes above and below the mills of Villebourg pointed out the difference between high and low water, and likewiſe formed the laſt limits of the operation.

Theſe marks were all made at the edge of the water exactly even with its ſurface, and all made at the different parts of the river nearly at the ſame inſtant of time. "The principal limits of the levelling (ſays Mr Adams) being now determined and fixed, it only remains to find the level between the limits, according to the methods already pointed out, uſing every advantage that may contribute to the ſucceſs of the work, and at the ſame time avoiding all obſtacles and difficulties that may retard or injure the operations. The firſt rule is always to take the ſhorteſt poſſible way from one limit to another, though this rule ought not to be followed if there are conſiderable obſtacles in the way, as hills, woods, marſhy ground, or if, by going aſide, any advantage can be obtained." In the preſent caſe it was found neceſſary to deviate very conſiderably from the general rule, in order to take in ſeveral ponds, the ſurfaces of which might all be taken for a perfect level; and thus levels were frequently taken acroſs the country for a conſiderable way. The difference of height between the mills of Lignebruk and Villebourg was at laſt found to be about 19 feet, indicating a deſcent of not quite a foot in a mile.

Levelling-Staves, inſtruments uſed in levelling, ſerving to carry the marks to be obſerved, and at the ſame time to meaſure the heights of thoſe marks from the ground. They uſually conſiſt of two mahogany ſtaves ten feet long, in two parts, that ſlide upon one another to about $5\frac{1}{10}$ feet, for the more portable carriage. They are divided into 1000 equal parts, and numbered at every tenth diviſion by 10, 20, 30, &c. to 1000; and on one ſide the feet and inches are alſo ſometimes marked.

Plate CCLXX. fig. 14.

A vane A ſlides up and down upon each ſide of theſe ſtaves, which by braſs ſprings will ſtand at any part. Theſe vanes are about 10 inches long and 4 inches broad; the breadth is firſt divided into three equal parts, the two extremes painted white, the middle ſpace divided again into three equal parts which are leſs; the middle one of them is alſo painted white, and the two other parts black; and thus they are ſuited to all the common diſtances. Theſe vanes have each a braſs wire acroſs a ſmall ſquare hole in the centre, which ſerves to point out the height correctly, by coinciding with the horizontal wire of the teleſcope of the level.

LEVEN, a river of Lenox or Dunbartonſhire in Scotland. See Lenox.

LEVER, in mechanics, is a bar of iron or wood, one part of which being ſupported by a prop, all other parts turn upon that prop as their centre of motion. This inſtrument is of two kinds. Firſt, the common ſort, where the weight we deſire to raiſe, reſts at one end of it, our ſtrength is applied at the other end, and the prop is between both. When we ſtir up the fire with a poker, we make uſe of this lever; the poker is the lever, it reſts upon one of the bars of the grate as a prop, the incumbent fire is the weight to be overcome, and the other end held in the hand is the ſtrength or power. In this as in all the reſt, we have only to increaſe the diſtance between the ſtrength and prop to give the man that works the inſtrument greater power.

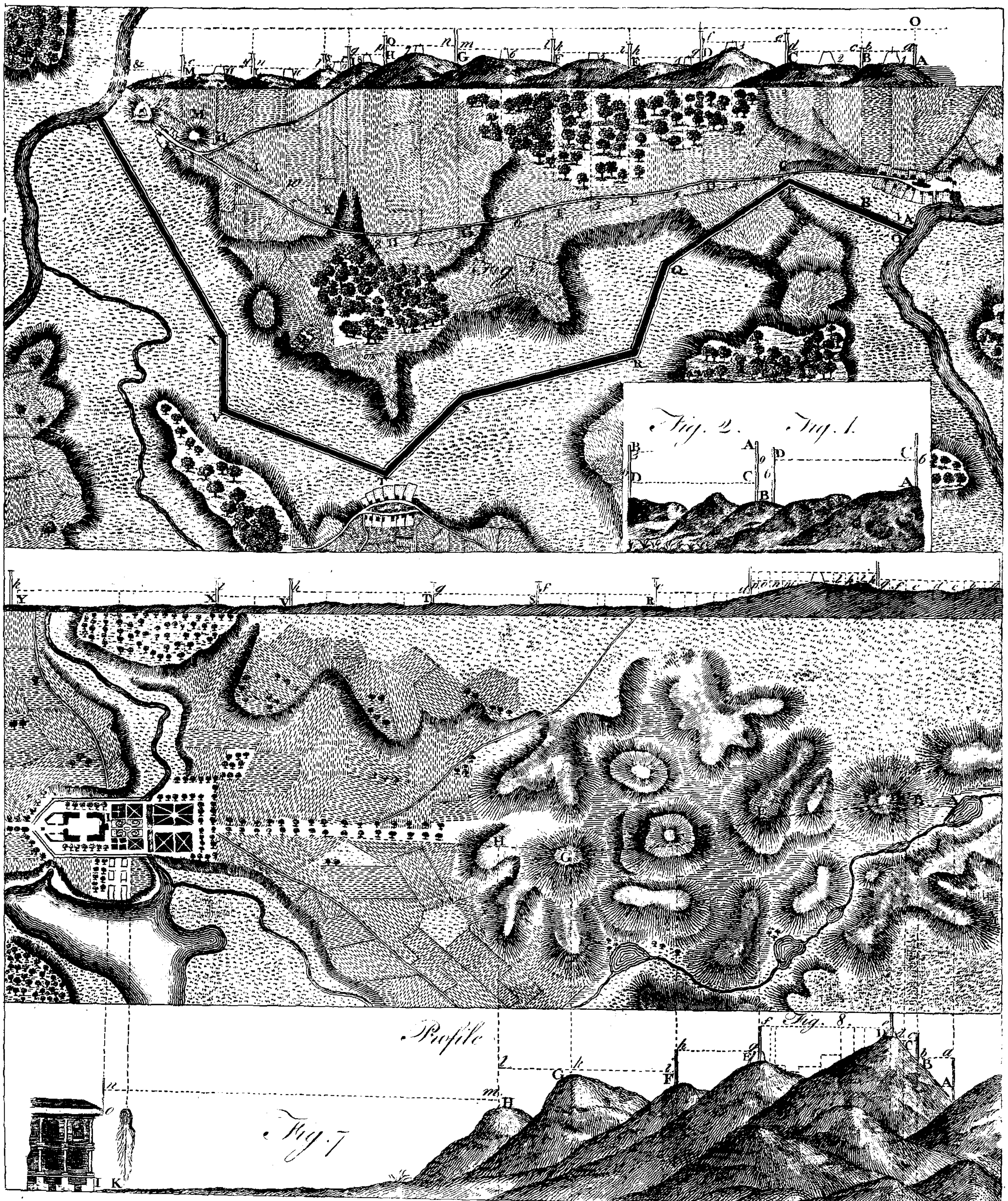
The lever of the ſecond kind, has the prop at one end, the ſtrength is applied to the other, and the weight to be raiſed reſts upon them. Thus in raiſing the water-plug in the ſtreets, the workman puts his iron lever through the hole of the plug till he reaches the ground on the other ſide, and, making that his prop, lifts the plug with his ſtrength at the other end of the lever. In this lever alſo, the greater the diſtance of the prop from the ſtrength, the greater is the workman's power.

Theſe inſtruments, as we ſee, aſſiſt the ſtrength; but ſometimes a workman is obliged to act at a diſadvantage, in raiſing either a piece of timber or a ladder upon one end. We cannot with grammatical propriety, call this a *lever*, ſince ſuch a piece of timber in fact in no way contributes to raiſe the weight. In this caſe, the man, who is the ſtrength or power, is in the middle, the part of the beam already raiſed is the weight, the part yet at the ground is the prop on which the beam turns or reſts. Here the man's ſtrength will be diminiſhed, in proportion to the weight it ſuſtains. The weight will be greater the farther it is from the prop, therefore the man will bear the greater weight the nearer he is to the prop. See Mechanics.

LEVERET, among ſportſmen, denotes a hare in the firſt year of her age.

LEVIGATION, in pharmacy and chemiſtry, the reducing hard and ponderous bodies to an impalpable powder, by grinding them on a porphyry, or in a mill. See Chemistry, nº 599.

A new method of reducing powders to a great degree of fineneſs has lately been invented by means of a fanner. This has the advantage over the other methods, in being much more expeditious, and attended with leſs trouble and expence; the degree of fineneſs to which they are reducible being thus alſo in a manner unlimited. The conſtruction of the fanner employed for this purpoſe is different from that employed for winnowing corn; the blaſt not being collected into a ſmall compaſs as in the latter, but diffuſed over a conſiderable ſpace, leſt a violent blaſt ſhould hurry off both coarſe and fine together. For this purpoſe, the leaves of the fanner are made as long in the direction parallel to the axis as can be done conveniently. In the other direction projecting from it, they differ not from the ordinary length, nor do they in the general ſituation with reſpect to each other. Before the leaves is a wooden partition reaching half way up, to prevent the groſs powder from falling in among the leaves, which reaches about half way from bottom to top; and about two feet or leſs from this, according to the ſize of the fanner, is another partition in a ſloping direction, reaching from the bottom of the box to near the top. The whole is incloſed in a large box ſix or ſeven feet long, having in the end fartheſt off from the leaves a ſlit equal to the ſpace left betwixt the top of the box and the ſloping partition already mentioned. On the top of this is another box, extending from the farthermoſt end of the former to the hopper which holds the coarſe powder, with a hole in the end neareſt to the fanner; and upon this another box, LEVELLING. Plate CCLXXI.



J. Trenchard, Sculp.

box, &c. as long as it is found that the air carries off with it any quantity of powder. This will be beſt underſtood from the following deſcription of the figure.

Plate CCLXXII. A repreſents the fanner itſelf, having a hole in the caſe for the admiſſion of the air, as uſual.

B, The firſt wooden diviſion, to prevent the return of the powder upon the leaves of the fanner.

C, the ſecond diviſion, reaching not quite to the top of the box. Its uſe is to direct the current of air produced by the fanner obliquely upwards: thus it ſtrikes the powder, falling down from the hopper, in the ſame oblique direction, and carries off the fine parts, firſt through the aperture *a*; after which ſome of them are lodged in the box D; the ſtill finer particles are carried through the aperture *b* into the ſecond box E, where part of them are lodged: they next paſs through the aperture *c* into the box F, and through *d* into the box G; the powder becoming ſtill finer and in ſmaller quantity as it aſcends into the higher boxes, until at laſt the waſte becomes ſo trifling, that the air may be allowed to paſs off entirely through the aperture *h* in the fourth or ſome other box, as is found moſt convenient.

Thus it is evident we may obtain powders of every degree of fineneſs, and ſuch as neither ſieve nor levigating mill could equal. Waſhing over with water may indeed produce powders equally fine; but the length of time requiſite for ſettling, and the trouble of drying them again, muſt decidedly give the preference to the fanner; eſpecially when we conſider, that there is not any occaſion for taking out the powder in ſmall quantities, as is the caſe in ſifting, waſhing, or levigating; but it may be allowed to remain till as much is collected in the boxes as we deſire.

The principal difficulty in the conſtruction of this fanner is the letting down the powder in a proper manner, ſo that the ſtream of air, which ought not to be very ſtrong, may freely paſs through it. For this purpoſe, the hopper muſt not let it fall in a large body, as in winnowing of corn, but in a long and thin ſheet, which can eaſily be pervaded. The beſt method ſeems to be to make the hopper extend the whole breadth of the box, having a narrow ſlit at bottom. Cloſe on the under part of this ſlit, a fluted roller ought to turn, which ſhutting up the aperture exactly, cannot allow any powder to paſs but what does ſo in conſequence of the hollow flutes of the roller; for a ſmooth round one would allow nothing to paſs. It would be proper alſo that the flutes be but ſmall, that a thin and nearly continued ſtream of powder be always deſcending; for this will contribute greatly to the fineneſs of the produce: and on this account the powder ought, before it is put into the hopper, to be paſſed through a lawn ſieve. In the figure, *e* repreſents the hopper, and *f* the fluted roller. Motion is eaſily communicated to the latter by means of a wheel faſtened on the axis of the fanner.

The coarſe powder is kept back by the partition C, and deſcends through a ſlit *i* in the bottom of the lowermoſt box, into a receptacle *k*, which may be removed occaſionally. All the joints and ſeams of the machine muſt be very cloſe, for the fine powder is very penetrating; for this reaſon alſo the hopper ought to have a lid.

LEWDNESS. See Fornication.—Lewdneſs is puniſhable by the Engliſh law by fine, impriſonment, &c. And Mich. 15 Car. II. a perſon was indicted for open lewdneſs, in ſhowing his naked body in a balcony, and other miſdemeanors; and was fined 2000 marks, impriſoned for a week, and bound to his good behaviour for three years. 1 Sid. 168. In times paſt, when any man granted a leaſe of his houſe, it was uſual to inſert an expreſs covenant, that the tenant ſhould not entertain any lewd women, &c.

LEVITE, in a general ſenſe, means all the deſcendants of Levi, among whom were the Jewiſh prieſts themſelves, who, being deſcended from Aaron, were likewiſe of the race of Levi. In a more particular ſenſe, *Levite* is uſed for an order of officers in that church, who were employed in performing the manual ſervice of the temple. They were obedient to the prieſts in their miniſtration, and brought them wood, water, and other neceſſaries for the ſacrifice.—They ſung and played upon inſtruments in the temple and in other places. They applied themſelves to the ſtudy of the law, and were the ordinary judges of the country, but always ſubordinate to the prieſts. Their ſubſiſtence was the tythes of corn, fruit, and cattle, throughout Iſrael: but the prieſts were intitled to a tenth of their tythes, by way of firſt-fruits to the Lord. Eight and forty cities were aſſigned for the reſidence of the Levites, of which the prieſts claimed thirteen, ſix whereof were choſen for cities of refuge. They were conſecrated, before they entered upon their miniſtry, by ſhaving their fleſh, waſhing their cloaths, and ſprinkling with the water of expiation. Impoſition of hands was uſed in conſecration, and two bullocks were offered at the door of the tabernacle. They waited weekly, and by turns, in the temple, beginning their attendance on one ſabbath and ending the next: During this time they were maintained out of the offerings, &c. In the time of Solomon, the number of Levites, from the age of 20 and capable of ſerving, was 38,000.

LEVITICUS, a canonical book of the Old Teſtament, ſo called from its containing the laws and regulations relating to the prieſts, Levites, and ſacrifices.

LEVITY, in phyſiology, the privation or want of weight in any body when compared with another that is heavier than it; in which ſenſe it ſtands oppoſed to gravity.

LEUK, a town of Switzerland, almoſt in the middle of the Valais; remarkable for its natural ſtrength, for the aſſembly of the ſtates that often meet there, and for its baths, whoſe water is ſo hot that they will boil eggs.

LEUNCLAVIUS (Joannes), a learned German, was deſcended from a noble family, and born at Amelbrun in Weſtphalia, 1533. He travelled through almoſt all the countries in Europe. While he was in Turkey, he collected very good materials for an "Hiſtory of the Ottoman Empire;" which he publiſhed, and alſo ſeveral other pieces concerning it, in Latin. He gave Latin tranſlations alſo of Xenophon, Zoſimus, &c. To a knowledge of the learned languages he added that of the civil law. He died at Vienna in 1593, aged 60.

LEUSDEN (John), a celebrated philologer, born in 1624. He ſtudied the learned languages and mathematics at Utrecht; and then went to Amſterdam, to converſe with the rabbis, and perfect himſelf in the Hebrew tongue. After which he was profeſſor of Hebrew at Utrecht, where he acquired a great reputation, and died in 1699. He wrote many valuable works; the principal of which are, 1. *Onomaſticum Sacrum*, 8vo. 2. *Clavis Hebraica & Philologica Veteris Teſtamenti*, 4to. 3. *Novi Teſtamenti Clavis Græca, cum Annotationibus Philologicis*, 8vo. 4. *Compendium Biblicum Veteris Teſtamenti*, 8vo. 5. *Compendium Græcum Novi Teſtamenti*; the beſt edition of which is that of London, in 1668, 12mo. 6. *Philologus Hebræus*, 4to. 7. *Philologus Hebræo mixtus*, 4to. 8. *Philologus Hebræo-Græcus*, 4to. 6. Notes on Jonas, Joel, Hoſea, &c. He alſo gave correct editions of ſeveral learned works.

LEUTKIRK, a free and imperial town of Germany, in Suabia, and in Algow, ſeated on a rivulet that falls into the Illar, in E. Long. 10. 10. N. Lat. 47. 53.

LEUTMERITZ, a town of Bohemia, capital of a circle of the ſame name, with a biſhop's ſee, ſeated on the river Elbe, in E. Long. 14. 25. N. Lat. 50. 34.

LEWARDEN, a handſome, rich, and ſtrong town of the United Provinces, capital of Oſtergow, Weſtergow, Sevenwolden, and Weſt Frieſland. It was the uſual place of reſidence of the Stadtholder; and in buildings, as well public as private, is very magnificent. It has ſeveral canals running through the ſtreets, which are of great ſervice to their trade, eſpecially as they are continued to the ſea and to the moſt conſiderable towns of the province. E. Long. 5. 42. N, Lat. 53. 12.

LEUWENHOEK (Anthony de), a celebrated Dutch phyſician and naturaliſt, was born at Delft in 1632, of an ancient family of that city; and acquired a very great reputation throughout all Europe, by his experiments and diſcoveries. He particularly excelled in making glaſſes for microſcopes and ſpectacles, and died in 1723. His letters to the royal ſociety of London, of which he was a member, were printed at Leyden, in 1722, in 4to.

LEVY, in law, ſignifies to gather or collect; as to levy money, and to levy a fine of lands in the paſſing a fine.

LEWENTZ, a town of Upper Hungary, in the county of Gran, and on the river of the ſame name, where the Turks were defeated in 1644. E. Long. 18. 19. N. Lat. 48. 15.

LEWES, a large well-built town of Suſſex in England, ſeated on an eminence on the banks of the river Ouſe, 50 miles from London. It is famous for a bloody battle near it, wherein King Henry III. was defeated and taken priſoner by the barons: and is ſo ancient, that we read the Saxon king Athelſtan appointed two mint-houſes here, and that in the reign of Edward the Confeſſor it had 127 burgeſſes. It is a borough by preſcription, by the ſtyle of conſtables and inhabitants. The conſtables are choſen yearly. It has handſome ſtreets and two ſuburbs, with ſix pariſh churches. It carries on a good trade; and the river Ouſe runs through it, which brings goods in boats and barges from a port 8 miles off. On this river are ſeveral iron-works, where cannon are caſt for merchant-ſhips, beſides other uſeful works. A charity-ſchool was opened here in 1711, where 20 boys are taught, clothed, and maintained, at the expence of a private gentleman, by whom they were alſo furniſhed with books; and 8 boys more are taught here at the expence of other gentlemen. Here are horſe-races almoſt every ſummer for the king's plate of L. 100. The roads here are deep and dirty; but then it is the richeſt ſoil in this part of England. The market here is on Saturday; and the fairs May 6. Whitſun-Tueſday, and October 2. The timber of this part of the county is prodigiouſly large. The trees are ſometimes drawn to Maidſtone and other places on the Medway, on a ſort of carriage called a *tug*, drawn by 22 oxen a little way, and then left there for other tugs to carry it on; ſo that a tree is ſometimes two or three years drawing to Chatham; becauſe, after the rain is once ſet in, it ſtirs no more that year, and ſometimes a whole ſummer is not dry enough to make the roads paſſable. It is cheap living here; and the town not being under the direction of a corporation, but governed by gentlemen, it is reckoned an excellent retreat for half-pay officers, who cannot ſo well confine themſelves to the rules of a corporation. It ſends two members to parliament.

LEWIS, one of the largeſt of the Hebrides or weſtern iſlands of Scotland, extending about 60 miles in length from north to ſouth, and from 13 to 14 in breadth, conſiſting of a great number of iſles and rocks, and parted by the ſea into two diviſions, called *Lewis* and *Harries*, the former lying to the weſtward of the other. Lewis belongs to the ſhire of Roſs; is divided by ſeveral channels, diſtinguiſhed by ſeveral names, and portioned out among different proprietors; but the *Lewis*, ſtrictly ſo called, ſtretches about 36 miles in length, from the north point of Bowling-head to the ſouthern extremity of Huſſineſs in Harries. The air is temperately cold, moiſt, and healthy; great part of the low ground is flooded with lakes; the reſt is arable in many places, and has been counted fruitful in oats, barley, rye, flax, and hemp. The ſoil in theſe parts is a light ſand, which the inhabitants manure with ſoot and ſea-ware; but great part of the iſland is covered with heath. The labouring people dig the land with ſpades, and break the clods with ſmall harrows, the foremoſt teeth of which are made of wood, and the remainder of rough heath, which ſmooths what the others have broken; and this harrow is drawn by one man, having a ſtrong trace of horſe-hair acroſs his breaſt. Of their corn they not only make malt for ale, but likewiſe a ſtrong ſpirit called *treſtareg*, which is the whiſky, or uſquebaugh, three times diſtilled. Lewis abounds with convenient bays and harbours, in which are caught, in great plenty, cod, ling, and herring: here are likewiſe whales of different ſizes, which the natives drive into the bays, and kill with harpoons. Theſe bays afford great plenty of ſhell-fiſh, ſuch as clams, oyſters, cockles, muſcles, lympits, welks, and ſuch a prodigious quantity of ſpout-fiſh is ſometimes caſt up from the ſand off Loch-tua, that they infect the air, and render it unhealthy to the neighbouring inhabitants, who are not able to conſume them, either by eating, or uſing them as manure for the ground. Some of theſe lochs and bays likewiſe produce ſmall coral and coralline. The freſh-water lakes are well ſtored with trout and eels, and the rivers yield plenty of ſalmon. Along the coaſt are found a great number of caves, which ſerve as ſhelter for the ſeals and otters, which are alſo eaten as dainties by the inhabitants; and vaſt numbers of ſea-fowl build upon the rocks and promontories.

The land-animals reared in this iſland, are cows, horſes, ſheep, goats, hogs, and deer; all theſe are of a diminutive ſize. The beef, mutton, and pork, are juicy and delicious; the horſes are active and hardy: the deer, which are of the red kind, confine themſelves to the chace of Oſervaul, about 15 miles in compaſs, which affords tolerable paſturage; but in the winter, when the ground is covered with froſt and ſnow, theſe animals are forced to feed on ſea-ware, and endure all the rigour of the ſeaſon, without any ſhelter from wood or copſe, for there is not a tree to be ſeen; nevertheleſs, the roots of very large trees, which have been cut by the ax, are found in different places. There is likewiſe a ſmall grove of birch and hazle on the ſouth-weſt ſide of Loch-Stornaway.

The inhabitants of Lewis are well-proportioned, tall, fair, ſanguine, ſtrong, and healthy. They are in general ſober, circumſpect, and hoſpitable; dexterous in ſhooting, ſwimming, and leaping; bold and ſkilful mariners; and ſo temperate, that they will tug at the oar all day, without any other proviſion than bread and water, with a ſnuff of tobacco.

Along this coaſt we ſee ſeveral natural mounts or forts, called *Dun*; ſuch as Dun rowly, Dun-coradel, and Dun-eiſten. There are alſo the remains of ſome old caſtles, and other monuments of antiquity. At Stornaway village we ſee the ruins of a fortreſs deſtroyed by the Engliſh garriſon ſent thither by Oliver Cromwell. To the northward of Brago there is a round tower built of large ſtones, three ſtories high, tapering towards the top, with a double wall, and a circular ſtaircaſe between, by which one may go quite round the building. On the heaths and ſummits of hills there are ſeveral cairns or heaps of ſtones, which ſerved either for graves or beacons. In the pariſh of Barvas we ſee a ſingle ſtone called the *thruſhel*, ſtanding upright, above 20 feet high, and almoſt as much in breadth. Three ſtones, about 12 feet high each, are ſeen ſtanding on the north ſide of Lock-carlvay; and many others ſtanding ſingle at great diſtances, and in remote parts of the iſland. But the moſt remarkable monument of this kind appears by the village of Claſſerniſs. Here we find 39 pyramidal ſtones ſtanding upright, about ſix or ſeven feet high from the ſurface, each about two feet in breadth. They are placed in form of an avenue, eight feet wide; the diſtance between every ſtone amounting to ſix feet, and a ſingle piece ſtands at the entrance. This avenue leads to a circle of 12 ſtones of the ſame dimenſions, with one in the centre 13 feet in length, and ſhaped like a rudder: on the eaſt, ſouth, and weſt ſides of this circle, are four ſtones, ſuch as thoſe that compoſe this round and avenue, forming three lines, or as it were rays from the body of the circle. This is ſuppoſed to have been a Druid temple; and tradition reports, that the chief Druid ſtood by the large ſtone in the centre, and harangued the audience. At the diſtance of a quarter of a mile there is another circle of the ſame nature; but without the range and avenue. In all probability, theſe, as well as the monuments we have deſcribed in our account of the Orkneys, and Stone-henge on Saliſbury-plain, were places of worſhip erected by the Druids in the time of Pagan ſuperſtition. The chief town in Lewis is called STORNAWAY.

There is a conſiderable number of inferior adjacent iſles and rocks, ſome of which hardly deſerve to be mentioned; ſuch as the ſmall iſland Garve at the mouth of Lock Carlvay, Berinſay, Fladda, Bernera Minor, and Bernera Major, Kailiſy, Cavay, Carvay, Grenim, Pabay, Shirem, Vexay, Wuya the Larger and Leſſer, and the Flannan iſlands, which the ſeamen denominate the *northern hunters*. Theſe are viſited every ſummer by the inhabitants of the Lewis, who go thither in queſt of fowls, eggs, down, quills, and feathers, as well as to ſhear or kill the ſheep that are kept here for paſture. As theſe iſlands are very ſteep and rocky, the viſitors, after having landed and climbed up the rock by a ladder, uncover their heads, and, making a turn ſun-ways, thank God for having eſcaped the danger they have undergone. In the largeſt iſland are the ruins of a chapel dedicated to St Flannan, from whom the iſles derive their name. Thither the fowlers repairing, ſtrip themſelves of their upper garments, which being laid upon a ſtone, they advance towards the altar, and repeat three prayers; an exerciſe which is performed every morning and evening. They obſerve many other ſuperſtitious cuſtoms during their reſidence on theſe rocks; and when they have loaded their boat with their purchaſe, return to the larger iſlands. Among the iſlands belonging to the Lewis, we may likewiſe take notice of the ſmall iſle of Pigmies, ſo called, becauſe bones reſembling thoſe of human creatures, but of very ſmall dimenſions, have been dug out of the ground.

The iſland of Lewis is divided into the two pariſhes of Barvas and Eye, and in each of theſe one miniſter is ſettled; but there is a great number of churches and chapels dedicated to different ſaints, in the different iſles which compoſe this cluſter. All theſe were ſanctuaries before the reformation, but now they are diveſted of that privilege. The people of theſe iſlands are Preſbyterians, with a few Proteſtants of the Engliſh communion, and a ſtill ſmaller number of Roman Catholics. The Proteſtants obſerve the feſtivals of Chriſtmas, Good Friday, Eaſter, and Michaelmas; on the laſt of which the individuals of both ſexes perform an anniverſary cavalcade.

LEWIS, or LOUIS, the name of ſeveral kings of France. See FRANCE.

LEWIS VII. anno 1137, was the firſt who had the courage to oppoſe the encroachments of the popes on the regal authority: Pope Innocent II. excommunicated him for appointing an archbiſhop of Bourges; but Lewis defended his prerogatives, and put the prieſts to death who had been the authors of the quarrel. In 1147, he put himſelf at the head of an army of 80,000 men, and marched againſt the Saracens, in the ſecond cruſade, but was defeated; and returning into France by ſea, was taken by the Greeks, but reſcued by Roger king of Sicily. His queen Eleonora accompanied him in this expedition; and being ſuſpected of infidelity with Saladin, a young Turk, Lewis divorced her, and ſhe was married ſix weeks after to Henry duke of Normandy, (Henry II. king of England). Lewis died in 1180, aged 60.

Lewis IX. anno 1226 (cannonized), was one of the greateſt monarchs of France; equally memorable for his valour and his virtues, but unfortunately miſled by the ſuperſtition of the times: he ſacrificed his own repoſe, and the welfare of his kingdom, to the folly of cruſading. In 1248, leaving France to the care of his mother, he embarked for Egypt, attended by his queen, his three brothers, and the flower of the French nobility. At firſt his victories were rapid: he took Damietta in 1249; but the following year he was defeated and taken priſoner by the Turks, with all the nobility in his train, and the greateſt part of his army. The ſultan ſent to him in priſon, to demand an exorbitant ſum for his ranſom; and his anſwer being truly noble, deſerves to be recorded: "Tell the ſultan, that a king of France is not to be ranſomed with money; I will give the ſum required for my people, and Damietta for myſelf." Theſe terms were accepted, and a peace of ten years enſued. Upon his return to France, he diminiſhed the taxes, revoked thoſe which the cupidity of the financiers had introduced; iſſued ſeveral ſalutary edicts; founded ſeveral churches and hoſpitals; and effectually overturned the eccleſiaſtical juriſdiction of the court of Rome, by his pragmatic ſanction in 1269, which eſtabliſhed the independency of the Gallican church. Thirteen years reſidence in his capital indemnified his ſubjects for his abſence; but his pious zeal prevented the enjoyment of this happineſs: he embarked for the ſixth cruſade in 1270; and died the ſame year, at the ſiege of Tunis, aged 55.

Lewis XI. anno 1461. His oppreſſions obliged his ſubjects to enter into a league againſt him, ſtyled "*Ligue de bien publique*," in which his brother the duke of Berri and ſome of the principal nobility were concerned: they ſolicited ſuccours from John duke of Calabria, who joined them with 500 Swiſs (the firſt introduction of Swiſs ſoldiers into the French armies.) His reign was almoſt one continued ſcene of civil war: and it is computed that 4000 of his ſubjects were executed in public and privately, either for being in arms againſt him, or ſuſpected by him. In his laſt illneſs, he drank the warm blood of children, in the vain hope of reſtoring his decayed ſtrength. He died in 1483, aged 60. The poſts for letters were eſtabliſhed in his reign, owing to his eagerneſs for news; the firſt inſtitution of this nature in Europe.

Lewis XII. anno 1492, ſtyled *the Juſt*, and *the Father of his people*; memorable for his valour in the field, and his wiſdom in the cabinet. A great general; but unfortunate towards the end of his reign, when he did not command his troops in perſon: his orders tranſmitted from home were miſunderſtood, or wilfully diſobeyed; and he had the mortification, before he died to ſee the total expulſion of the French from the poſſeſſions he had acquired for them by his perſonal bravery. At 53 years of age, he married the princeſs Mary of England, ſiſter of Henry VIII. and being of a delicate conſtitution, fell a victim (according to the French hiſtorians) to amorous dalliance; for he died in about two months after his nuptials, in 1515.

Lewis XIII. anno 1610, increaſed the military reputation of his country, and made conſiderable additions to its domains. The beginning of his reign was occupied in civil wars with his mother and his Proteſtant ſubjects; in which he was excited to continue by his famous miniſter cardinal Richelieu, who attended him to the ſiege of Rochelle, the bulwark of the Huguenot party. This place was reduced by famine to ſurrender, in 1628, after a ſiege of more than a year. Upon this and other occaſions, the king gave proofs of great perſonal bravery. His attachment to his ally the duke de Nevers, who ſucceeded to the duchy of Mantua, but was refuſed the inveſtiture by Charles VI. emperor of Germany, involved him in a war with that prince, the Spaniards, and the duke of Savoy; in which Lewis was victorious; and obtained a treaty of peace, by which the duke of Mantua was guarantied in the poſſeſſion of his dominions. In 1635, a new war broke out between France and Spain, and the emperor took part with the latter: it laſted 13 years againſt the emperor, and 25 againſt Spain, with various ſucceſs; and the different armies kept on foot, in the Low Countries, on the frontiers of France, and in Italy, in the firſt years of this war, paved the way for the ſucceſſes of Lewis XIV. the campaigns of theſe armies being a military ſchool of diſcipline and experience for the French officers, beſides giving them a knowledge of the countries which became the ſeat of war in the next reign. Lewis XIII. died 1643, aged 41.

Lewis XIV. *le Grand* (king at five years of age), anno 1643. He was at firſt ſtyled *Dieu-donne*, becauſe the French conſidered him as the gift of heaven, granted to their prayers after the queen had been barren 22 years. This princeſs (Anne of Auſtria) was declared regent by Lewis XIII, and ſaw herſelf under a neceſſity to continue the war againſt Philip IV. king of Spain, her brother. The duke d'Enguin was made general of the French armies; and ſo ſignal was the ſucceſs of this renowned warrior (afterwards prince of Condé, and known by the ſtyle of *the Great Condé*), that his victories brought on the advantageous treaties of Munſter in 1648, between France, the emperor Ferdinand III. and Chriſtiana queen of Sweden: the baſis of the aggrandiſement of France in this reign; the principal events of which, and of the next, are related under the articles Britain, *United Provinces*, &c. Lewis XIV. died in 1715, aged 77.

Lewis XV. (his great-grandſon) ſucceeded in 1715. He was ſtyled, in the courſe of his reign, *the well-beloved*, which he loſt ſome years before he died; and was deteſted and deſpiſed by his ſubjects for his ſhameful attachment to a young girl, under the title of his *miſtreſs*, who, by the miniſtry of her patron the duke d'Aiguillon, governed the kingdom, and invaded the ancient rights and privileges of the people. He died in 1774, in the 64th year of his age and 59th of his reign.

LEXINGTON, a town of North America, and at preſent the capital of the ſtate of Kentucky, is ſituated on Elkhorn a northern branch of Kentucky River. It was founded in 1779, and is now a flouriſhing town, containing upwards of 200 houſes and about 1500 inhabitants. Lexington contains two printing preſſes, and a large number of uſeful mechanics and manufactures; alſo upwards of 30 ſtores well ſupplied with goods of all kinds.

LEX, Law. See Law.—The Roman laws were of three kinds: 1ſt, Such as were made by their kings. 2d, The laws of the twelve tables brought by the *Decemviri* from Athens, &c. And 3d, Such as were propoſed by the ſuperior magiſtrates in the times of the republic. The laws of this laſt claſs were enacted in the following manner.

No law could be propoſed but by ſome of the following magiſtrates, viz. the *Prætor*, the *Conſuls*, the *Dictator*, the *Interrex*, the *Decemviri*, the *Military Tribunes*, *Triumviri*, and *Tribunes* of the people. If any of theſe propoſed a law, it was firſt committed to writing, and privately examined as to its utility and probable conſequences, by ſome perſons well qualified for the taſk; ſometimes it was referred to the whole ſenate for their ſentiments. It was then hung up publicly for three market-days, that all the people might have time to examine it, and conſider its tendency: This was called *legis promulgatio, quaſi provulgatio.* If the perſon who framed the bill did not ſee cauſe in the mean time to drop it, the people were convened in *comitia*, and he addreſſed them in an oration, being alſo ſeconded by his friends, ſetting forth the expediency and probable utility of ſuch a law: This was called *rogatio legis*, becauſe the addreſs was always prefaced with this petitionary form of words, *Velitis jubeatiſne, Quirites?* "Will you, O Romans, conſent and order this law to paſs?" This being done, thoſe that diſliked the motion delivered their ſentiments in oppoſition to it. An urn was then brought to certain prieſts who attended upon the occaſion, into which were caſt the names of the tribes, centuries, or *curia* as the *comitia* happened to be *tributa*, *centuriata*, or *curiata*. The names were ſhaken together; and the firſt drawn tribe or century was called *prærogativa*, becauſe their ſuffrages were firſt taken. The *curia* that was firſt drawn was called *principium* for the ſame reaſon. The other tribes, centuries, &c. were called *tribus jure vocatæ*, *centuriæ jure vocatæ*, &c.

Matters being in this ſituation, the *veto* or negative voice of the tribunes of the people might put an entire end to the proceedings, and diſſolve the aſſembly. The tribune's interference was called *interceſſio*. The conſul alſo had it in his power to ſtop further proceedings, by commanding any of the holidays called *feriæ imperativæ* to be obſerved. The *comitia* would of courſe be diſſolved alſo by any of the perſons preſent being ſeized with the falling-ſinckeſs, or upon the appearance of any unlucky omen. But ſuppoſing the buſineſs to meet with no interruption of this ſort, the people were each of them preſented with two tablets, on one of which was written in large characters A. on the other U. R. Their diſapprobation of the bill was expreſſed by throwing into an urn the tablet inſcribed A. ſignifying "I forbid it;" *antiquo*, "I prefer the old." Their aſſent was ſignified by throwing in the tablet marked U. R. i. e. *uti rogas*, "be it as you deſire." According to the majority of theſe tablets the law paſſed or not. If it paſſed, it was written upon record, and carried into the treaſury; this was called *legem ferre*. Afterwards it was engraved upon plates of braſs, and hung up in the moſt public and conſpicuous places: this was termed *legem figere*, and a future repeal of this law was *legem refigere*.

If a law paſſed in the *comitia curiata*, it was called *lex curiata*; if in the *comitia centuriata*, it had the name of *lex centuriata*; but if it paſſed in the *comitia tributa*, it was termed *plebiſcitum*. The laws, too, generally bore the names of the propoſers, as *lex Ælia*, *lex Fuſia*, &c.

Romulus uſed to make laws by his own ſingle authority, but ſucceeding kings ſought the approbation of the people.

LEXIARCHI, at Athens, ſix officers aſſiſted by 30 inferior ones, whoſe buſineſs it was to lay fines upon ſuch as came not to the public aſſemblies, and alſo to make ſcrutiny among ſuch as were preſent.

The lexiarchi kept a regiſter of the age, manners, and abilities of all the citizens, who were always inrolled at the age of 20.

LEXICON, the ſame with dictionary. The word is chiefly uſed in ſpeaking of Greek Dictionaries: it is derived from the Greek λεξις, *word, diction*; of λετω *I ſpeak.*

LEYDEN, in Latin *Lugdunum Batavorum*, one of the largeſt and fineſt cities in Holland, abounds with canals, along which are rows of lofty trees that afford very pleaſant walks. An arm or ſmall branch of the Rhine runs through it. Over the canals are 145 bridges, moſt of them of ſtone or brick. The univerſity here is the oldeſt in the United Provinces: it has large privileges; a library well furniſhed, and particularly rich in manuſcripts; a phyſic-garden well ſtocked with all ſorts of plants, many of which have been brought from the Cape of Good Hope and the Eaſt Indies; an anatomy-hall, well provided with ſkeletons; and an obſervatory. The profeſſors, who are generally very eminent, read public lectures four times a week, for which they take no money, but about three guineas are paid for a courſe of private lectures, which laſts a whole year. The ſtudents have no diſtinct habit, but all wear ſwords, though they generally go to the public and private lectures in their night-gowns and ſlippers. The ſalaries of the profeſſors are from 100 l. to 200 l. a-year: they wear gowns only when they preſide at public diſputations, read public lectures, or meet in the ſenate; and their lectures are always in Latin. The ſtudents do not lodge in the univerſity, but where they pleaſe in the town. The cloth manufacture here is much decayed, which formerly flouriſhed to ſuch a degree, that 100,000 pieces, it is ſaid, have ſometimes been made in a year. The city is famous for the long and ſevere ſiege it maintained in 1573 againſt the Spaniards. We cannot help mentioning the reply of that illuſtrious magiſtrate, Adrian de Verf, when the citizens repreſented to him the havoc made by the famine during the ſiege, and inſiſted upon his ſurrendering: "Friends (ſaid he), here is my body, divide it among you to ſatisfy your hunger, but baniſh all thoughts of ſurrendering to the cruel and perfidious Spaniard." They took his advice, in regard to their not ſurrendering, and never would liſten to any overtures; but told the Spaniards, they would hold out as long as they had one arm to eat and another to fight. There are ſome fine churches here, and many long, broad, handſome, ſtreets; but the Papiſts, as at Haerlem, are more numerous than the Proteſtants.

Leyden Phial, a phial coated on the inſide and outſide with tinfoil, or other proper conducting ſubſtance, and

and furniſhed with a braſs wire and knob, for giving the electrical ſhock. See ELECTRICITY-*Index*.

Lucas van LEYDEN. See LUCAS.

LEYSERA, in botany: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ*. The receptacle is naked; the pappus paleaceous; that of the diſc plumy; the calyx ſcarious.

LEYTE, one of the Philippine iſlands in the Eaſt Indies, ſituated in E. Long. 118. 0. N. Lat. 11. 0. Its greateſt length is about 40 leagues, and its circumference about 90 or 100. Its ſoil on the eaſt ſide is very fruitful; but there are very high mountains which cut it almoſt through the middle, and occaſion ſo great an alteration in the air, that when it is winter on the north ſide, it is ſummer on the ſouthern part of the iſland. Thus when the inhabitants of one half of the iſland reap, the others ſow; and they have two plentiful harveſts in a year, to which the rivers running down from the abovementioned mountains contribute not a little. The iſland contains about 9000 inhabitants, who pay tribute to the Spaniards in rice, wax, and quilts.

LHUYD, or LHOYD (Humphrey), a learned antiquarian of the 16th century, born at Denbigh, who applied himſelf to the ſtudy of phyſic; and living moſtly within the walls of Denbigh caſtle, practiſed there as a phyſician; and died in 1570, with the character of a well-bred gentleman. He wrote and tranſlated ſeveral pieces relative to hiſtory and antiquities; in particular, The hiſtory of Cambria, now called *Wales*, from Caradoc of Langcarvan, &c. but died before it was finiſhed: however, Sir Henry Sidney, lord preſident of Wales, employed Dr David Powel to finiſh it, who publiſhed it in 1584. A new and improved edition of this work was publiſhed in 1774.

LHUYD (Edward), keeper of the Muſeum at Oxford, was a native of South Wales, the ſon of Charles Lhuyd, Eſq; of Lhanvorde. He was educated at Jeſus College, Oxford, where he was created M. A. July 21. 1701. He was bred under Dr Plot, whom he ſucceeded as keeper of the Aſhmolean muſeum, and had the uſe of all Vaughan's collections. With inceſſant labour and great exactneſs he employed a conſiderable part of his life in ſearching into the Welch antiquities: had peruſed or collected a great deal of ancient and valuable matter from their MSS. tranſcribed all the old charters of their monaſteries that he could meet with; travelled ſeveral times over Wales, Cornwall, Scotland, Ireland, Armoric Bretagne, countries inhabited by the ſame people, compared their antiquities, and made obſervations on the whole; but died in July 1709, before he had digeſted them into the form of a diſcourſe, as he intended, on the ancient inhabitants of that iſland. The untimely death of this excellent antiquary prevented the completing of many admirable deſigns. For want of proper encouragement, he did very little towards underſtanding the Britiſh bards, having ſeen but one of thoſe of the ſixth century, and not being able to procure acceſs to two of the principal libraries in the country. He communicated many obſervations to Biſhop Gibſon, whoſe edition of the *Britannia* he reviſed; and publiſhed "*Archæologia Britannica*, giving ſome accounts additional to what has been hitherto publiſhed of the languages, hiſtories, and cuſtoms of the original inhabitants of Great Britain, from collections and obſervations in travels through Wales, Cornwall, Bas Bretagne, Ireland, and Scotland, Vol. I. Gloſſography, Oxford 1707," fol. He left in MS. a Scottiſh or Iriſh-Engliſh Dictionary, propoſed to be publiſhed in 1732 by ſubſcription, by Mr David Malcolme, a miniſter of the church of Scotland, with additions; as alſo the Elements of the ſaid language; with neceſſary and uſeful informations for propagating more effectually the Engliſh language, and for promoting the knowlege of the ancient Scottiſh or Iriſh, and very many branches of uſeful and curious learning. Lhuyd, at the end of his preface to the Archæologia, promiſes an hiſtorical dictionary of Britiſh perſons and places mentioned in ancient records. It ſeems to have been ready for preſs, though he could not ſet the time of publication. His collections for a ſecond volume, which was to give an account of the antiquities, monuments, &c. in the principality of Wales, were numerous and well choſen; but, on account of a quarrel between him and Dr Wynne, then fellow, afterwards principal of the college, and biſhop of St Aſaph, he refuſed to buy them, and they were purchaſed by Sir Thomas Seabright, of Beachwood in Hertfordſhire, in whoſe library the greateſt part ſtill remain, but ſo indigeſted, and written with ſo many abbreviations, that nobody can undertake to publiſh them. They conſiſt of about 40 volumes in folio, 10 in quarto, and above 100 ſmaller, and all relate to Iriſh or Welſh antiquities, and chiefly in thoſe languages. Carte made extracts from them about or before 1736; but theſe were chiefly hiſtorical. Sir John Seabright has given Mr Pennant 23 of Lhuyd's MSS. Latin and Engliſh. Many of his letters to Liſter, and other learned contemporaries, were given by Dr Fothergill to the univerſity of Oxford, and are now in the Aſhmolean muſeum. Lhuyd undertook more for illuſtrating this part of the kingdom than any one man beſides ever did, or than any one man can be equal to.

LIBANIUS, a famous Greek rhetorician and ſophiſt in the 4th century, was born at Antioch, and had a great ſhare in the friendſhip of Julian the Apoſtate. That prince offered him the dignity of *Præfectus Prætorio*; but Libanius refuſed it, thinking the name of *ſophiſt*, or *profeſſor of eloquence*, much more honourable. There are ſtill extant ſeveral of his letters and Greek orations, by which he acquired great reputation; but his ſtyle is ſomewhat affected and obſcure. He was a pagan. Baſil and Chryſoſtom were his diſciples about the year 360. His letters were publiſhed at Amſterdam in 1738; his orations at Venice, 1755.

LIBANOMANTIA, in antiquity, a ſpecies of divination performed with frankincenſe; which, if it preſently caught fire, and ſent forth a grateful odour, was eſteemed a happy omen, and *vice verſa*.

LIBANUS, the name of a chain of mountains of Turkey in Aſia, which lie between Proper Syria and Paleſtine, extending, from weſt to eaſt, from the Mediterranean ſea as far as Arabia. The ſummits of theſe mountains are ſo high, that they are always covered with ſnow; but below are very pleaſant, and fruitful valleys. They were formerly famous for the great number of cedar-trees growing thereon; but now there are very few remaining. Geographers diſtinguiſh this chain into Libanus and Antilibanus; the latter of which lies on the ſouth-ſide of the Valley, riſing near the ruins of Sidon, and terminates at others in Arabia, in N. Lat. 34. They are ſeparated from each other at an equal diſtance throughout; and form a baſon, or country, called by the ancients *Cœlo Syriâ*.

LIBATION, amongſt the Greeks and Romans, was an eſſential part of ſolemn ſacrifices. It was alſo performed alone, as a drink offering, by way of procuring the protection and favour of the gods, in the ordinary affairs of life. Libations, according to the different natures of the gods in honour of whom they were made, conſiſted of different liquids, but wine was the moſt uſual. The wine offered to the gods was always unmixed with water. We meet with libations of water, libations of honey, libations of milk, and libations of oil; theſe are called νηφαλια Ιερα. The libation was made with a ſerious deportment and ſolemn prayer. At ſacrifices, the libation, after it had been taſted by the prieſt, and handed to the bye-ſtanders, was poured upon the victim. At entertainments, a little wine was generally poured out of the cup, before the liquor began to circulate, to ſhow their gratitude to the gods for the bleſſings they enjoyed.

Libations were alſo in uſe among the Hebrews, who poured an hin of wine on the victim after it was killed, and the ſeveral pieces of the ſacrifice were laid on the altar, ready to be conſumed in the flames.

LIBAW, a ſea-port town of Courland, lying on the Baltic ſea, conſiſting entirely of wooden-houſes. It belongs to the duke of Courland, and is ſituated in E. Long. 21. 27. N. Lat. 56. 27.

LIBEL, *(libellus famoſus)*, taken in its largeſt and moſt extenſive ſenſe, ſignifies any writing, picture, or the like, of an immoral or illegal tendency; but, in a peculiar ſenſe, is uſed to denote a malicious defamation of any perſon, and eſpecially a magiſtrate, made public by either printing, writing, ſigns, or pictures, in order to provoke him to wrath, or expoſe him to public hatred, contempt, and ridicule. The direct tendency of theſe libels is the breach of the public peace, by ſtirring up the objects of them to revenge, and perhaps to bloodſhed. The communication of a libel to any one perſon is a publication in the eye of the law: and therefore the ſending an abuſive private letter to a man is as much a libel as if it were openly printed, for it equally tends to a breach of the peace.

With regard to libels in general, there are, as in many other caſes, two remedies; one by indictment and another by action. The former for the *public* offence; for every libel has a tendency to break the peace, or provoke others to break it: which offence is the ſame whether the matter contained be true or falſe; and therefore the defendant, on an indictment for publiſhing a libel, is not allowed to allege the truth of it by way of juſtification. But in the remedy by action on the caſe, which is to repair the party in damages for the injury done him, the defendant may, as for words ſpoken, juſtify the truth of the facts, and ſhow that the plaintiff has received no injury at all. What was ſaid with regard to words ſpoken, will alſo hold in every particular with regard to libels by writing or printing, and the civil actions conſequent thereupon: but as to ſigns or pictures, it ſeems neceſſary always to ſhow, by proper inuendos and averments of the defendant's meaning, the import and application of the ſcandal, and that ſome ſpecial damage has followed; otherwiſe it cannot appear, that ſuch libel by picture was underſtood to be levelled at the plaintiff, or that it was attended with any actionable conſequences.

In a civil action, then, a libel muſt appear to be falſe, as well as ſcandalous; for, if the charge be true, the plaintiff has received no private injury, and has no ground to demand a compenſation for himſelf, whatever offence it may be againſt the public peace: and therefore, upon a civil action, the truth of the accuſation may be pleaded in bar of the ſuit. But, in a criminal proſecution; the tendency which all libels have to create animoſities, and to diſturb the public peace, is the ſole conſideration of the law. And therefore, in ſuch proſecutions, the only points to be conſidered are, firſt, the making or publiſhing of the book or writing; and, ſecondly, whether the matter be criminal: and, if both theſe points are againſt the defendant, the offence againſt the public is complete. The puniſhment of ſuch libellers, for either making, repeating, printing, or publiſhing the libel, is a fine, and ſuch corporal puniſhment as the court in its diſcretion ſhall inflict; regarding the quantity of the offence, and the quality of the offender. By the law of the twelve tables at Rome, libels, which affected the reputation of another, were made a capital offence: but, before the reign of Auguſtus, the puniſhment became corporal only. Under the emperor Valentinian it was again made capital, not only to write, but to publiſh, or even to omit deſtroying them.—Our law, in this and many other reſpects, correſponds rather with the middle age of Roman juriſprudence, when liberty, learning and humanity, were in their full vigour, than with the cruel edicts that were eſtabliſhed in the dark and tyrannical ages of the ancient decemviri, or the latter emperors.

In this, and other inſtances, where blaſphemous, immoral, treaſonable, ſchiſmatical, ſeditious, or ſcandalous libels are puniſhed by the Engliſh law, ſome with a greater, others with a leſs degree of ſeverity; the *liberty of the preſs*, properly underſtood, is by no means infringed or violated. See *Liberty of the Preſs*.

LIBELLA, a piece of money amongſt the Romans, being the tenth part of the denarius, and equal in value to the as. It was called *libella*, as being a little pound, becauſe equal to a pound of braſs.—Its value in our money is 1 ob. 1 qu. or a half-penny farthing. See Money.

Libella, or *Libellula*, in zoology, a genus of four-winged flies, called by the Engliſh *dragon-flies*, or *adder flies*; the characters of which are theſe: The mouth is furniſhed with jaws; the feelers are ſhorter than the breaſt; and the tail of the male terminates in a kind of hooked forceps. There are 21 ſpecies, chiefly diſtinguiſhed by their colour. They have all two very large and reticulated eyes, covering the whole ſurface of the head. They fly very ſwiftly; and prey upon the wing, clearing the air of innumer-

Plate CCLXXIV.

able little flies. They are found in Auguſt and September in the fields and gardens, eſpecially near places where there are waters, as they have their origin from worms living in that element. The great ones uſually live all their time about waters; but the ſmaller are common among hedges, and the ſmalleſt of all frequent gardens. The ſmaller kind often ſettle upon buſhes, or upon the ground; but the large ones are almoſt always upon the wing, ſo that it is very difficult to take them. Their eyes are beautiful objects for the microſcope. The largeſt ſpecies is produced from a water-worm that has ſix feet, which, yet young and very ſmall, is transformed into a chryſalis, that has its dwelling in the water. People have thought they diſcovered them to have gills like fiſhes. It wears a maſk as perfectly formed as thoſe that are worn at a maſquerade; and this maſk, faſtened to the inſect's neck, and while it moves at will, ſerves it to hold its prey while it devours it. The period of transformation being come, the chryſalis makes to the water-ſide, undertakes a voyage in ſearch of a convenient place; fixes on a plant, or ſticks faſt to a bit of dry wood. Its ſkin, grown parched, ſplits at the upper part of the thorax. The winged inſect iſſues forth gradually, throws off its ſlough, expands its wings, flutters, and then flies off with gracefulneſs and eaſe. The elegance of its ſlender ſhape, the richneſs of its colours, the delicacy and reſplendent texture of its wings, afford infinite delight to the beholder. The ſexual parts of the libellulæ are differently ſituated in the male and female. It is under the body at the joining of the thorax, that thoſe parts are diſcovered in the males: thoſe of the females are known by a ſlit placed at the extremity of the body. Their amours conclude in a rape. The male, while hovering about, watches, and then ſeizes the female by the head with the pincers with which the extremity of the tail is armed. The raviſher travels thus through the air, till the female yielding to ſuperior ſtrength, or rather to inclination, forms her body into a circle that terminates at the genitals of the male, in order to accompliſh the purpoſe of nature. Theſe kinds of rapes are common. Libellulæ are ſeen thus coupled in the air, exhibiting the form of a ring. The female depoſits her eggs in the water, from whence ſpring water-worms, which afterwards undergo the ſame transformation.

Barbut's Inſects.

LIBELLI, was the name given to the bills which were put up amongſt the Romans, giving notice of the time when a ſhow of gladiators would be exhibited, with the number of combatants, and other circumſtances. This was called *munus pronunciare* or *proponere*.—Theſe bills were ſometimes termed *edicta*. Theſe public notices were given by the perſon who deſigned to oblige the people with the ſhow, and were frequently attended with pictures repreſenting the engagement of ſome celebrated gladiators. This cuſtom is alluded to by Horace, lib. ii. ſat. vii. v. 96, &c.

There was alſo the *famoſus libellus*, a defamatory libel. Seneca calls them *contumelioſi libelli*, infamous rhymes, which by a Roman ordinance were puniſhable with death. Libellus alſo in the civil law ſignifies the declaration, or ſtate of the proſecutor's charge againſt the defendant; and it has the like ſignification in the ſpiritual courts.

LIBER, in vegetables, the bark or rind, principally of trees. This is to be conceived as conſiſting of a number of cylindric and concentric ſurfaces whoſe texture is reticular, and in ſome trees plainly extruſible every way, by reaſon that the fibres are ſoft and flexible. While in this condition, they are either hollow regular canals, or, if not ſo, they have interſtitial ſpaces which ſerve the office of canals. The nutritious juice which they are continually receiving, remains in part in them, makes them grow in length and thickneſs, and ſtrengthens and brings them cloſer together; and by this means the texture which was before reticular becomes an aſſemblage of ſtraight fibres ranged vertically and parallel to each other; that is, as they are thus altered behind one another, they by degrees become a new ſubſtance, more woody, called *blea*.

LIBERA, in mythology, the name of a goddeſs, which Cicero in his book Of the Gods, repreſents as the daughter of Jupiter and Ceres. Ovid in his Faſti ſays that the name was given by Bacchus to Ariadne. Libera is exhibited on medals as a kind of female Bacchus crowned with vine leaves.

LIBERAL ARTS, are ſuch as depend more on the labour of the mind than on that of the hands; or, that conſiſts more in ſpeculation than operation; and have a greater regard to amuſement and curioſity than to neceſſity.

The word comes from the Latin *liberalis*, which among the Romans ſignified a perſon who was not a ſlave; and whoſe will, of conſequence, was not checked by the command of any maſter.

Such are grammar, rhetoric, painting, ſculpture, architecture, muſic, &c. The liberal arts uſed formerly to be ſummed up in the following Latin verſe:

Lingua, Tropus, Ratio, Numerus, Tonus, Angulus, Aſtra.

And the mechanical arts, which, however, are innumerable, under this:

Rus, Nemus, Arma, Faber, Vulnera, Lana, Rates.

See ARTS.

LIBERALIA, feaſts celebrated by the ancient Romans, in honour of Liber or Bacchus, the ſame with thoſe which the Greeks called DIONYSIA, and *Dionyſiaca*.

They took their name from *liber*, i. e. *free*, a title conferred on Bacchus in memory of the liberty or freedom which he granted to the people of Bœotia; or, perhaps, becauſe wine, whereof he was the reputed deity, delivers men from care, and ſets their mind at eaſe and freedom. Varro derives the name of this feaſt from *liber*, conſidered as a noun adjective, and ſignifying *free*; becauſe the prieſts were free from their function, and eaſed of all care, during the time of the liberalia: as the old women officiated in the ceremonies and ſacrifices of theſe feaſts.

LIBERIA, in Roman antiquity, a feſtival obſerved on the 16th of the kalends of April, at which time the youth laid aſide their juvenile habit for the toga virilis, or habit peculiar to grown men. See the article TOGA.

LIBERTINES, LIBERTINI, in eccleſiaſtical hiſtory, a religious ſect, which aroſe in the year 1525, whoſe principal tenets were, that the deity was the ſole operating cauſe in the mind of man, and the immediate author of all human actions; that, conſequently, the diſtinctions of good and evil, which had been eſtabliſhed with regard to thoſe actions, were falſe and groundleſs, and that men could not, properly ſpeaking, commit ſin; that religion conſiſted in the union of the ſpirit or rational ſoul with the Supreme Being; that all thoſe who had attained this happy union, by ſublime contemplation and elevation of mind, were then allowed to indulge, without exception or reſtraint, their appetites or paſſions; that all their actions and purſuits were then perfectly innocent; and that, after the death of the body, they were to be united to the Deity. They likewiſe ſaid that Jeſus Chriſt was nothing but a mere *je ne ſçai quoi*, compoſed of the ſpirit of God, and of the opinion of men.

Theſe maxims occaſioned their being called *Libertines;* and the word has been uſed in an ill ſenſe ever ſince.

The *Libertini* ſpread principally in Holland and Brabant. Their leaders were one Quintin, a Picard, Pockeſius, Ruffus, and another called Chopin, who joined with Quintin, and became his diſciple.

This ſect obtained a certain footing in France thro' the favour and protection of Margaret, queen of Navarre, and ſiſter to Francis I. and found patrons in ſeveral of the reformed churches. This ſect was probably a remnant of the more ancient Beguards or Brethren of the Free Spirit.

Libertines of Geneva, were a cabal of rakes rather than of fanatics; for they made no pretences to any religious ſyſtem, but pleaded only for the liberty of leading voluptuous and immoral lives. This cabal was compoſed of a certain number of licentious citizens, who could not bear the ſevere diſcipline of Calvin, who puniſhed with rigour not only diſſolute manners, but alſo whatever bore the aſpect of irreligion and impiety. In this turbulent cabal there were ſeveral perſons who were not only notorious for their diſſolute and ſcandalous manner of living, but alſo for their atheiſtical impiety, and contempt of all religion. To this odious claſs belonged one Gruet, who denied the divinity of the Chriſtian religion, the immortality of the ſoul, the difference between moral good and evil, and rejected with diſdain the doctrines that are held moſt ſacred among Chriſtians; for which impieties he was at laſt brought before the civil tribunal, in the year 1550, and condemned to death. The Genevan ſpirit of reformation, improperly directed by the violence and zeal of Calvin, did at this time operate to a degree which has marked the character of this great reformer with reproach. For in 1544, Sebaſtian Caſtalio, maſter of the public ſchool at Geneva, who was a man of probity, and diſtinguiſhed by his learning and taſte, was, nevertheleſs, depoſed from his office and baniſhed the city, becauſe he diſapproved ſome of the meaſures that were purſued, and ſome of the opinions entertained by Calvin and his colleagues, and particularly that of abſolute and unconditional predeſtination. Jerome Bolſec alſo a man of genius and learning, who became a convert to the Proteſtant religion and fled to Geneva for protection, was caſt into priſon, and ſoon after ſent into baniſhment, becauſe, in 1551, he imprudently and indecently declaimed, in full congregation and at the cloſe of public worſhip, againſt the doctrine of abſolute decrees.

LIBERTUS, or LIBERTINUS, among the Romans, a freedman, or a perſon ſet free from a legal ſervitude.

Theſe ſtill retained ſome mark of their ancient ſtate: he who made a ſlave free having a right of patronage over the *libertus*; ſo that if the latter failed of ſhowing due reſpect to his patron, he was reſtored to his ſervitude; and if the *libertus* died without children, his patron was his heir. See SLAVE.

In the beginning of the republic, *libertinus* denoted the ſon of a *libertus* or freedman; but afterwards, before the time of Cicero, and under the emperors the terms *libertus* and *libertinus*, as Suetonius has remarked, were uſed as ſynonymous.

LIBERTY, denotes a ſtate of freedom, in contradiſtinction to *ſlavery* or *reſtraint*; and may be conſidered as either *natural* or *civil*.

The abſolute rights of man, conſidered as a free agent, endowed with diſcernment to know good from evil, and with power of chooſing thoſe meaſures which appear to him to be moſt deſirable, are uſually ſummed up in one general appellation, and denominated the *natural liberty of mankind*. This natural liberty conſiſts properly in a power of acting as one thinks fit, without any reſtraint or controul, unleſs by the law of nature; being a right inherent in us by birth, and one of the gifts of God to man at his creation, when he endued him with the faculty of free-will. But every man, when he enters into ſociety, gives up a part of his natural liberty, as the price of ſo valuable a purchaſe; and, in conſideration of receiving the advantages of mutual commerce, obliges himſelf to conform to thoſe laws which the community has thought proper to eſtabliſh. And this ſpecies of legal obedience and conformity is infinitely more deſireable than that wild and ſavage liberty which is ſacrificed to obtain it. For no man, that conſiders a moment, would wiſh to retain the abſolute and uncontrouled power of doing whatever he pleaſes: the conſequence of which is, that every other man would alſo have the ſame power; and then there would be no ſecurity to individuals in any of the enjoyments of life.

Political, therefore, or *civil*, liberty, which is that of a member of ſociety, is no other than natural liberty, ſo far reſtrained by human laws (and no farther) as is neceſſary and expedient for the general advantage of the public. Hence we may collect, that the law which reſtrains a man from doing miſchief to his fellow citizens, though it diminiſhes the natural, increaſes the civil liberty of mankind: but every wanton and cauſeleſs reſtraint of the will of the ſubject, whether practiſed by a monarch, a nobility, or a popular aſſembly, is a degree of tyranny. Nay, that even laws themſelves, whether made with or without our conſent, if they regulate and conſtrain our conduct in matters of mere indifference, without any good end in view, are laws deſtructive of liberty: whereas, if any public advantage can ariſe from obſerving ſuch precepts, the controul of our private inclinations, in one or two particular points, will conduce to preſerve our general freedom in others of more importance, by ſupporting that ſtate of ſociety which alone can ſecure our independence. Thus the ſtatute of king Edward IV. wich forbad the fine gentlemen of thoſe times (under the degree of a lord) to wear pikes upon their ſhoes or boots of more than two inches in length, was a law that ſavoured of oppreſſion; becauſe, however ridiculous the faſhion then in uſe might appear, the reſtraining it by pecuniary penalties could ſerve no purpoſe of common utility. But the ſtatute of king Charles II. which preſcribes a thing ſeemingly as indifferent, *viz.* a dreſs for the dead, who were all ordered to be buried in woollen, is a law conſiſtent with public liberty; for it encourages the ſtaple trade, on which in a great meaſure depends the univerſal good of the nation. So that laws when prudently framed, are by no means ſubverſive, but rather introductive, of liberty; for (as Mr Locke has well obſerved) where there is no law there is no freedom. But then, on the other hand, that conſtitution or frame of government, that ſyſtem of laws, is alone calculated to maintain civil liberty, which leaves the ſubject entire maſter of his own conduct, except in thoſe points wherein the public good requires ſome direction or reſtraint.

The idea and practice of this political or civil liberty flouriſh in their higheſt vigour in America, where it falls little ſhort of perfection, and can only be loſt or deſtroyed by the folly or demerits of its owner. The legiſlature and of courſe the laws of Britain, alſo being peculiarly adapted to the preſervation of this ineſtimable bleſſing even in the meaneſt ſubject, are very different from the modern conſtitutions of other ſtates on the continent of Europe, and from the genius of the imperial law; which in general are calculated to veſt an arbitrary and deſpotic power, of controuling the actions of the ſubject, in the prince, or in a few grandees. And this ſpirit of liberty is ſo deeply implanted in their conſtitution, and rooted even in their very ſoil, that a ſlave or a negro, the moment he lands in Britain, falls under the protection of the laws, and ſo far becomes a freeman; though the maſter's right to his ſervice may poſſibly ſtill continue.

"The abſolute rights of every Briton (which, taken in a political and extenſive ſenſe, are uſually called their *liberties*), as they are founded on nature and reaſon, ſo they are coeval with their form of government; though ſubject at times to fluctuate and change, their eſtabliſhment (excellent as it is) being ſtill human. At ſome times we have ſeen them depreſſed by overbearing and tyrannical princes; at others, ſo luxuriant as even to tend to anarchy, a worſe ſtate than tyranny itſelf, as any government is better than none at all. But the vigour of their free conſtitution has always delivered the nation from theſe embarraſſments: and, as ſoon as the convulſions conſequent on the ſtruggle have been over, the balance of their rights and liberties has ſettled to its proper level; and their fundamental articles have been from time to time aſſerted in parliament, as often as they were thought to be in danger:"

Blackſt. Comment.

Firſt, by the great charter of liberties, which was obtained, ſword in hand, from king John, and afterwards, with ſome alterations, confirmed in parliament by king Henry III. his ſon. Which charter contained very few new grants; but, as Sir Edward Coke obſerves, was for the moſt part declaratory of the principal grounds of the fundamental laws of England. Afterwards, by the ſtatute called *confirmatio cartarum*, whereby the great charter is directed to be allowed as the common law; all judgments contrary to it are declared void; copies of it are ordered to be ſent to all cathedral churches, and read twice a year to the people; and ſentence of excommunication is directed to be as conſtantly denounced againſt all thoſe that by word, deed, or counſel, act contrary thereto, or in any degree infringe it. Next by a multitude of ſubſequent corroborating ſtatutes (Sir Edward Coke reckons 32), from the firſt Edward to Henry IV. Then, after a long interval, by *the petition of right*; which was a parliamentary declaration of the liberties of the people, aſſented to by king Charles I. in the beginning of his reign: Which was cloſely followed by the ſtill more ample conceſſions made by that unhappy prince to his parliament, before the fatal rupture between them; and by the many ſalutary laws, particularly the *habeas corpus* act, paſſed under Charles II. To theſe ſucceeded *the bill of rights*, or declaration delivered by the lords and commons to the prince and princeſs of Orange, 13th February 1688; and afterwards enacted in parliament, when they became king and queen: which declaration concludes in theſe remarkable words; "and they do claim, demand, and inſiſt upon, all and ſingular the premiſes, as their undoubted rights and liberties." And the act of parliament itſelf recogniſes "all and ſingular the rights and liberties aſſerted and claimed in the ſaid declaration to be the true, ancient, and indubitable rights of the people of this kingdom."—Laſtly, theſe liberties were again aſſerted at the commencement of the preſent century, in the *act of ſettlement*, whereby the crown was limited to his preſent majeſty's illuſtrious houſe; and ſome new proviſions were added at the ſame fortunate era, for better ſecuring their religion, laws, and liberties; which the ſtatute declares to be "the birthright of the people of England," according to the ancient doctrine of the common law.

Thus much for the *declaration* of their rights and liberties. The rights themſelves, thus defined by theſe ſeveral ſtatutes, conſiſt in a number of private immunities; which will appear, from what has been premiſed, to be indeed no other, than either that *reſiduum* of natural liberty, which is not required by the laws of ſociety to be ſacrificed to public convenience; or elſe thoſe civil privileges, which ſociety hath engaged to provide, in lieu of the natural liberties ſo given up by individuals. Theſe therefore were formerly, either by inheritance or purchaſe, the rights of all mankind; but in moſt other countries of the world, being now more or leſs debaſed and deſtroyed, they at preſent may be ſaid to remain, in a peculiar and emphatical manner, the rights of the people of Britain. And theſe may be reduced to three principal or primary articles; the right of perſonal ſecurity, the right of perſonal liberty, and the right of private property: becauſe, as there is no other known method of compulſion, or of abridging man's natural free-will, but by an infringement or diminution of one or other of theſe important rights, the preſervation of theſe inviolate may juſtly be ſaid to include the preſervation of their civil immunities in their largeſt and moſt extenſive ſenſe. See the article Rights.

In vain, however, would theſe rights be declared, aſcertained, and protected by the dead letter of the laws, if the conſtitution had provided no other method to ſecure their actual enjoyment. It has therefore eſtabliſhed certain other auxiliary ſubordinate rights of the ſubject, which ſerve principally as barriers to protect and maintain inviolate the three great and primary

mary rights, of perſonal ſecurity, perſonal liberty, and private property. Theſe are,

1. The conſtitution, powers, and privileges of parliament; for which ſee PARLIAMENT.

2. The limitation of the king's prerogative, by bounds ſo certain and notorious, that it is impoſſible he ſhould exceed them without the conſent of the people; as to which, ſee PREROGATIVE. The former of theſe keeps the legiſlative power in due health and vigour, ſo as to make it improbable that laws ſhould be enacted deſtructive of general liberty: the latter is a guard upon the executive power, by reſtraining it from acting either beyond or in contradiction to the laws that are framed and eſtabliſhed by the other.

3. A third ſubordinate right of every Briton is that of applying to the courts of juſtice for redreſs of injuries. Since the law is, in this realm, the ſupreme arbiter of every man's life, liberty, and property, courts of juſtice muſt at all times be open to the ſubject, and the law be duly adminiſtered therein. The emphatical words of *magna carta*. ſpoken in the perſon of the king, who in judgment of law (ſays Sir Edward Coke) is ever preſent and repeating them in all his courts, are theſe: *Nulli vendemus, nulli negabimus, aut differemus rectum vel juſtitiam;* "and therefore every ſubject (continues the ſame learned author), for injury done to him *in bonis, in terris, vel perſona*, by any other ſubject, be he eccleſiaſtical or temporal, without any exception, may take his remedy by the courſe of the law, and have juſtice and right for the injury done to him, freely without ſale, fully without any denial, and ſpeedily without delay." It were endleſs to enumerate all the *affirmative* acts of parliament, wherein juſtice is directed to be done according to the law of the land: and what that law is, every ſubject knows; or may know if he pleaſes: for it depends not upon the arbitrary will of any judge; but is permanent, fixed, and unchangeable, unleſs by authority of parliament. We ſhall however juſt mention a few *negative* ſtatutes, whereby abuſes, perverſions, or delays of juſtice, eſpecially by the prerogative, are reſtrained. It is ordained by *magna carta*, that no freeman ſhall be outlawed, that is, put out of the protection and benefit of the laws, but according to the law of the land. By 2 Edw. III. c. 8. and 11 Ric. II. c. 10. it is enacted, that no commands or letters ſhall be ſent under the great ſeal, or the little ſeal, the ſignet or privy ſeal, in diſturbance of the law; or to diſturb or delay common right: and, though ſuch commandments ſhould come, the judges ſhall not ceaſe to do right: which is alſo made a part of their oath by ſtatute 18 Edw. III. ſt. 4. And by firſt W. & M. ſt. 2. c. 2. it is declared, that the pretended power of ſuſpending or diſpenſing with laws, or the execution of laws, by regal authority without conſent of parliament, is illegal.

Not only the ſubſtantial part, or judicial deciſions, of the law, but alſo the formal part, or method of proceeding, cannot be altered but by parliament: for, if once thoſe outworks were demoliſhed, there would be an inlet to all manner of innovation in the body of the law itſelf. The king, it is true, may erect new courts of juſtice; but then they muſt proceed according to the old eſtabliſhed forms of the common law. For which reaſon it is declared in the ſtatute 16 Car. I. c. 10. upon the diſſolution of the court of ſtar-chamber, that neither his majeſty, nor his privy-council, have any juriſdiction, power, or authority, by Engliſh bill, petition, articles, libel (which were the courſe of proceeding in the ſtar-chamber, borrowed from the civil law), or by any other arbitrary way whatſoever, to examine, or draw into queſtion, determine, or diſpoſe of the lands or goods of any ſubjects of this kingdom; but that the ſame ought to be tried and determined in the ordinary courts of juſtice, and by *courſe of law*.

4. If there ſhould happen any uncommon injury, or infringement of the rights before mentioned, which the ordinary courſe of law is too defective to reach, there ſtill remains a fourth ſubordinate right, appertaining to every individual, namely, the right of petitioning the king, or either houſe of parliament, for the redreſs of grievances. In Ruſſia we are told, that the Czar Peter eſtabliſhed a law, that no ſubject might petition the throne till he had firſt petitioned two different miniſters of ſtate. In caſe he obtained juſtice from neither, he might then preſent a third petition to the prince; but upon pain of death, if found to be in the wrong. The conſequence of which was, that no one dared to uſe ſuch third petition; and grievances ſeldom falling under the notice of the ſovereign, he had little opportunity to redreſs them. The reſtrictions, for ſome there are, which are laid upon petitioning in Britain, are of a nature extremely different; and while they promote the ſpirit of peace, they are no check upon that of liberty. Care only muſt be taken, leſt, under the pretence of petitioning, the ſubject be guilty of any riot or tumult; as happened in the opening of the memorable parliament in 1640: and, to prevent this, it is provided by the ſtatute 13 Car. II. ſt. 1. c. 5. that no petition to the king, or either houſe of parliament, for any alteration in church or ſtate, ſhall be ſigned by above 20 perſons, unleſs the matter thereof be approved by three juſtices of the peace, or the major part of the grand jury, in the county; and in London, by the lord mayor, aldermen, and common-council: nor ſhall any petition be preſented by more than 10 perſons at a time. But, under theſe regulations, it is declared by the ſtatute 1 W. & M. ſt. 2. c. 2. that the ſubject hath a right to petition; and that all commitments and proſecutions for ſuch petitioning are illegal.

5. The fifth and laſt auxiliary right of the ſubject, that we ſhall at preſent mention, is that of having arms for their defence, ſuitable to their condition and degree, and ſuch as are allowed by law. Which is alſo declared by the ſame ſtatute 1 W. & M. ſt. 2. c. 2. and is indeed a public allowance, under due reſtrictions, of the natural right of reſiſtance and ſelf-preſervation, when the ſanctions of ſociety and laws are found inſufficient to reſtrain the violence of oppreſſion.

In theſe ſeveral articles conſiſt the rights, or, as they are frequently termed, *the liberties of Britons*: liberties more generally talked of, than thoroughly underſtood; and yet highly neceſſary to be perfectly known and conſidered by every man of rank or property, leſt his ignorance of the points whereon they are founded ſhould hurry him into faction and licentiouſneſs on the one hand, or puſillanimous indifference and criminal ſubmiſſion on the other. And we have ſeen that theſe rights, conſiſt, primarily, in the free enjoyment of perſonal ſecurity, of perſonal liberty, and of private property. So long as theſe remain inviolate, the ſubject is perfectly free; for every ſpecies of compulſive tyranny and oppreſſion muſt act in oppoſition to one or other of theſe rights, having no other object upon which it can poſſibly be employed. To preſerve theſe from violation, it is neceſſary that the conſtitution of parliaments be ſupported in its full vigour; and limits, certainly known, be ſet to the royal prerogative. And, laſtly, to vindicate theſe rights, when actually violated or attacked, the ſubjects of Britain are intitled, in the firſt place, to the regular adminiſtration and free courſe of juſtice in the courts of law; next, to the right of petitioning the king and parliament for redreſs of grievances; and, laſtly, to the right of having and uſing arms for ſelf preſervation and defence. And all theſe rights and liberties it is our birthright to enjoy entire; unleſs where the laws of our country have laid them under neceſſary reſtraints. Reſtraints in themſelves ſo gentle and moderate, as will appear upon further inquiry, that no man of ſenſe or probity would wiſh to ſee them ſlackened. For all of us have it in our choice to do every thing that a good man would deſire to do; and are reſtrained from nothing, but what would be pernicious either to ourſelves or our fellow-citizens. So that this review of our ſituation may fully juſtify the obſervation of a learned French author, who indeed generally both thought and wrote in the ſpirit of genuine freedom; and who hath not ſcrupled to profeſs, even in the very boſom of his native country, that the Britiſh is the only nation in the world, where political or civil liberty is the direct end of its conſtitution. Recommending therefore to the ſtudent in our laws a farther and more accurate ſearch into this extenſive and important title, we ſhall cloſe our remarks upon it with the expiring wiſh of the famous Father Paul to his country, "ESTO PERPETUA!"

LIBERTY *and neceſſity*. See METAPHYSICS.

LIBERTY *of the Preſs*. The art of printing, ſoon after its introduction, was looked upon in England, as well as in other countries, as merely a matter of ſtate, and ſubject to the coercion of the crown. It was therefore regulated by the king's proclamations, prohibitions, charters of privilege and licence, and finally by the decrees of the court of ſtar-chamber, which limited the number of printers, and of preſſes which each ſhould employ, and prohibited new publications unleſs previouſly approved by proper licenſers. On the demolition of this odious juriſdiction in 1641, the long parliament of Charles I. after their rupture with that prince, aſſumed the ſame powers as the ſtar-chamber had exerciſed with reſpect to the licenſing of books: and in 1643, 1647, 1649, and 1652 (Scobell. i. 44. 134. ii. 88,230.) iſſued their ordinances for that purpoſe, founded principally on the ſtar-chamber decree of 1637. In 1662, was paſſed the ſtatute 13 & 14 Car. II. c. 33. which, with ſome few alterations, was copied from the parliamentary ordinances. This act expired in 1679; but was revived by ſtatute 1 Jac. II. c. 17. and continued till 1692. It was then continued for two years longer by ſtatute 4 W. & M. c. 24. but though frequent attempts; were made by the government to revive it, in the ſubſequent part of that reign (Com. Journ. 11 Feb. 1694. 26 Nov. 1695. 22 Oct. 1696. 9 Feb. 1697. 31 Jan. 1698.) yet the parliament reſiſted it ſo ſtrongly, that it finally expired, and the preſs became properly free in 1694, and has continued ſo ever ſince.

The liberty of the preſs, however, ſo eſſential to the nature of a free ſtate, conſiſts not in freedom from cenſure for any criminal matter that may be publiſhed, but in laying no previous reſtrains upon publications. Every freeman has undoubtedly a right to lay what ſentiments he pleaſes before the public; to forbid this, is to deſtroy the freedom of the preſs: but if he publiſhes what is improper, miſchievous, or illegal, he muſt take the conſequence of his own temerity†. To ſubject the preſs to the reſtrictive power of a licenſer in the manner abovementioned, is to ſubject all freedom of ſentiment to the prejudices of one man, and make him the arbitrary and infallible judge of all controverted points in learning, religion, and government. But to puniſh (as the law does at preſent) any dangerous or offenſive writings which, when publiſhed, ſhall, on a fair and impartial trial, be adjudged of a pernicious tendency, is neceſſary for the preſervation of peace and good order, of government and religion, the only ſolid foundations of civil liberty. Thus the will of individuals is ſtill left free; the abuſe only of that free-will is the object of legal puniſhment. Neither is any reſtraint hereby laid upon freedom of thought or inquiry; liberty of private ſentiment is ſtill left; the diſſeminating or making public of bad ſentiments, deſtructive of the ends of ſociety, is the crime which ſociety corrects. A man (ſays a fine writer on this ſubject) may be allowed to keep poiſons in his cloſet, but not publicly to vend them as cordials. And to this we may add, that the only plauſible argument heretofore uſed for reſtraining the juſt freedom of the preſs, "that it was neceſſary to prevent the daily abuſe of it," will entirely loſe its force, when it is ſhown (by a ſeaſonable exertion of the laws) that the preſs cannot be abuſed to any bad purpoſe without incurring a ſuitable puniſhment: whereas, it can never be uſed to any good one when under the controul of an inſpector. So true will it be found, that to cenſure the licentiouſneſs, is to maintain the liberty of the preſs.

LIBERTY, in mythology, was a goddeſs both among the Greeks and Romans. Among the former ſhe was invoked under the title *Eleutheria*; and by the latter ſhe was called *Libertas*, and held in ſingular veneration; temples, altars, and ſtatues, were erected in honour of this deity. A very magnificent temple was conſecrated to her on mount Aventin, by Tiberius Gracchus, before which was a ſpacious court, called *atrium libertatis*. The Romans alſo erected a new temple in honour of Liberty, when Julius Cæſar eſtabliſhed his empire over them, as if their liberty had been ſecured by an event which proved fatal to it. In a medal of Brutus, Liberty is exhibited under the figure of a woman, holding in one hand a cap, the ſymbol of Liberty, and two poinards in the other, with the inſcription IDIBVS MARTIIS.

LIBETHRA (anc. geog.), the fountain of ſong, was ſituated in Magneſia, a diſtrict of Macedonia annexed to Theſſaly; diſtinct from the town of Libethra, which ſtood on the mount Olympus, where it verges

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† See *Libel*.

verges towards Macedonia: hence the Muſes are called *Libethrides*, (Virgil). Strabo places on Helicon, not only Hippocrene, and the temple of the Muſes, but alſo the cape of the nymphs Libethrides.

LIBETHRIUS MONS (anc. geog.), a mountain of Bœotia, diſtant from Coronea 40 ſtadia; where ſtood the ſtatues of the muſes, and of the nymphs, ſurnamed *Libethride*. A mountain probably conjoined with, or at leaſt very near to, Helicon.

LIBITINA, in the Roman mythology, a goddeſs which preſided over funerals. This goddeſs was the ſame with the *Venus infera* or *Epithymbia* of the Greeks. She had a temple at Rome, where was lodged a certain piece of money for every perſon who died, whoſe name was recorded in a regiſter called *Libitinæ ratio*. This practice was eſtabliſhed by Servius Tullius, in order to obtain an account of the number of annual deaths in the city of Rome, and conſequently the rate of increaſe or decreaſe of its inhabitants.

LIBITINARII, were undertakers whoſe office it was to take care of funerals, prepare all things neceſſary upon the ſolemn occaſion, and furniſh every article required.—They got their livelihood by this gloomy buſineſs, and kept a number of ſervants to perform the working part of the profeſſion, ſuch as the *pollinctores*, *veſpillones*, &c. The name *Libitinarii* is derived from *Libitina*, the goddeſs of funerals, in whoſe temple were ſold all things relating to funerals. See FUNERAL.

LIBNA (anc. geog.), a ſacerdotal city in the tribe of Judah, a place of ſtrength, as appears from Sennacherib's laying ſiege to it, 2 Kings xix. Iſaiah xxxvii. In Jerome's, time, a village, called *Lobna*, in the territory of Eleutheropolis.

LIBOURNE, a town of France, in Guienne, and in Bourdelois. It is a populous trading town, and is ſeated on the rive Dordogne. W. Long. 0. 10. N. Lat. 44. 55.

LIBRA, or BALANCE, one of the mechanical powers. See BALANCE.

LIBRA, in aſtronomy, one of the 12 ſigns of the zodiac, and exactly oppoſite to Aries; ſo called becauſe when the ſun is in this ſign at the autumnal equinox, the days and nights are equal as if weighed in a balance.—The ſtars in this conſtellation according to Ptolemy are 17, Tycho 10, Hevelius 20, and Flamſtead 51.

LIBRA alſo denotes the ancient Roman pound, borrowed from the Sicilians, who called it *litra*.

The libra was divided into 12 *untiæ* or ounces, and the ounce into 26 ſcruples,

The diviſions of the libra were, the *uncia*, one twelfth; the *ſextans*, one ſixth; the *quadrans*, one fourth; the *triens*, one third; the *quincunx*, five ounces; the *ſemis*, ſix; the *ſeptunx*, ſeven; the *bes*, eight; the *dodrans*, nine: the *dextrans*, ten; the *deunx*, eleven; laſtly, the *as* weighed twelve ounces or one libra.

The Roman libra was uſed in France for the proportions of their coin till the time of Charlemagne, or perhaps till that of Philip I. in 1093, their ſols being ſo proportioned, as that 20 of them were equal to the libra. By degrees it became a term of account; and every thing of the value of twenty ſols was called a *livre*.

LIBRA *penſa*, in our law books, denotes a pound of money in weight. It was uſual in former days not only to tell the money but to weigh it; becauſe many cities, lords, and biſhops, having their mints, coined money, and often very bad too: for which reaſon, though the pound conſiſted of 20 ſhillings, they always weighed it.

LIBRARII, among the ancients, were a ſort of copyiſts who tranſcribed in beautiful or at leaſt legible characters, what had been written by the notarii in notes and abbreviatures.

LIBRARY, an edifice or apartment deſtined for holding a conſiderable number of books placed regularly on ſhelves; or the books themſelves lodged in it.

Some authors refer the origin of libraries to the Hebrews; and obſerve, that the care theſe took for the preſervation of their ſacred books, and the memory of what concerned the actions of their anceſtors, became an example to other nations, particularly to the Egyptians. Oſmanduas, king of Egypt, is ſaid to have taken the hint firſt; who, according to Diodorus, had a library built in his palace, with this inſcription over the door, ΨΥΧΗΣ ΙΑΓΡΕΙΟΝ. Nor were the Ptolemies, who reigned in the ſame country, leſs curious and magnificent in books.

The ſcripture alſo ſpeaks of a library of the kings of Perſia, Ezra v. 17. vi. 1. which ſome imagine to have conſiſted of the hiſtorians of that nation, and of memoirs of the affairs of ſtate; but, in effect, it appears rather to have been a depoſitory of laws, charters, and ordinances of the kings. The Hebrew text calls it the *houſe of treaſures*, and afterwards the *houſe of the rolls*, where the treaſures were laid up. We may, with more juſtice, call that a *library*, mentioned in the ſecond of Eſdras to have been built by Nehemiah, and in which were preſerved the books of the prophets, and of David, and the letters of their kings.

The firſt who erected a library at Athens, was the tyrant Piſiſtratus: and yet Strabo refers the honour of it to Ariſtotle. That of Piſiſtratus was tranſported by Xerxes into Perſia, and was afterwards brought back by Seleucus Nicanor to Athens. Long after, it was plundered by Sylla, and re-eſtabliſhed by Hadrian. Plutarch ſays, that under Eumenes there was a library at Pergamus, containing 200,000 books. Tyrannian, a celebrated grammarian, contemporary with Pompey, had a library of 30,000 volumes. That of Ptolemy Philadelphus, according to A. Gellius, contained 700,000, all in rolls, burnt by Cæſar's ſoldiers.

Conſtantine, and his ſucceſſors, erected a magnificent one at Conſtantinople; which in the eighth century contained 300,000 volumes, all burnt by order of Leo Iſaurus; and, among the reſt, one wherein the Iliad and Odyſſey were written in letters of gold, on the guts of a ſerpent.

The moſt celebrated libraries of ancient Rome, were the Ulpian, and the Palatine. They alſo boaſt much of the libraries of Paulus Æmilius, who conquered Perſeus; of Lucilius Lucullus, of Aſinius Pollio, Atticus, Julius Severus, Domitius, Serenus, Pamphilius Martyr, and the emperors Gordian and Trajan.

Anciently every large church had its library; as appears by the writings of St Jerome, Anaſtaſius, and others. Pope Nicholas laid the firſt foundation of that of the Vatican, in 1450. It was deſtroyed by the conſtable Bourbon, in the ſacking of Rome, and reſtored by Pope Sixtus V. and has been conſiderably enriched with the ruins of that of Heidelberge, plundered by Count Tilly in 1622. One of the moſt complete libraries in Europe, was ſaid to be that erected at Florence by Coſmo de Medicis, over the gate whereof is written, LABOR ABSQUE LABORE; though it is now exceeded by that of the French king, begun by Francis I. augmented by Cardinal Richelieu, and completed by M. Colbert.

The emperor's library at Vienna, according to Lambecius, conſiſts of 80,000 volumes, and 15,940 curious medals.

The Bodleian library at Oxford, built on the foundation of that of Duke Humphrey, exceeds that of any univerſity in Europe, and even thoſe of all the ſovereigns of Europe, except the emperor's and French king's, which are each of them older by 100 years. It was firſt opened in 1602, and has ſince found a great number of benefactors: particularly Sir Robert Cotton, Sir H. Savil, Archbiſhop Laud, Sir Kenelm Digby, Mr Allen, Dr Pococke, Mr Selden, and others. The Vatican, the Medicean, that of Beſſarion at Venice, and thoſe juſt mentioned, exceed the Bodleian in Greek manuſcripts; which yet outdoes them all in Oriental manuſcripts.

As to printed books, the Ambroſian at Milan, and that of Wolfenbuttle, are two of the moſt famous, and yet both inferior to the Bodleian.

King's LIBRARY, at St James's, was founded by Henry, eldeſt ſon of James I. and made up partly of books, and partly of manuſcripts with many other curioſities, for the advancement of learning. It has received many additions from the libraries of Iſaac Caſaubon and others.

Cottonian LIBRARY, orginally conſiſted of 958 volumes of original charters, grants, inſtruments, letters, of ſovereign princes, tranſactions between Britain and other kingdoms and ſtates, genealogies, hiſtories, regiſters of monaſteries, remains of Saxon laws, the book of Geneſis, thought to be the moſt ancient Greek copy extant, and ſaid to have been written by Origen in the ſecond century, and the curious Alexandrian copy or manuſcript in Greek capitals. This library is kept in the Britiſh Muſeum, with the large and valuable library of Sir Hans Sloane, amounting to upwards of 42,000 volumes. &c. There are many public libraries belonging to the ſeveral colleges at Oxford and Cambridge, and the univerſities in North Britain. The principal public libraries in London, beſide that of the Muſeum, are thoſe of the college of heralds, of the college of phyſicians, of Doctors Commons, to which every biſhop, at the time of his conſecration, gives at leaſt 20 l. ſometimes of 50 l. for the purchaſe of books; thoſe of the Gray's Inn, Lincoln's Inn, Inner Temple, and Middle Temple; that of Lambeth, founded by Archbiſhop Bancroft in 1610, for the uſe of ſucceeding archbiſhops of Canterbury, and increaſed by the benefactions of Archbiſhops Abbot, Sheldon, and Tenniſon, and ſaid to conſiſt of at leaſt 15,000 printed books, and 617 volumes in manuſcript: that of Red-Croſs ſtreet, founded by Dr Daniel Williams, a preſbyterian divine, and ſince enriched by many private benefactions; that of the Royal Society, called the *Arundelian* or *Norfolk library*, becauſe the principal part of the collection formerly belonged to the family of Arundel, and was given to the ſociety by Henry Howard, afterwards duke of Norfolk, in 1666, which library has been increaſed by the valuable collection of Francis Aſton, Eſq; in 1715, and is continually increaſing by the numerous benefactions of the works of its learned members, and others: that of St Paul's, of Sion college; the queen's library, erected by queen Caroline in 1737; and the ſurgeon's library kept in their hall in the Old Bailey, &c.

In Edinburgh there is a good library belonging to the univerſity, well furniſhed with books; which are kept in good order. There is alſo a noble library of books and manuſcripts belonging to the faculty of advocates. See ADVOCATE.

LIBRATION, in aſtronomy, an apparent irregularity of the moon's motions whereby ſhe ſeems to librate about her axis, ſometimes from the eaſt to the weſt, and now and then from the weſt to the eaſt. See ASTRONOMY, n° 420.

LIBURNIA (anc. geog.), a diſtrict of Illyricum, extending towards the Adriatic between Iſtria on the weſt, Dalmatia on the eaſt, and mount Albius on the north. *Liburni*, the people. The apparitors, who at the command of the magiſtrate ſummoned the people from the country, were called *Liburni*, becauſe generally men of *Liburnia—Liburna* or *Liburnica*, (Horace). denoted a kind of light and ſwift ſkiff, uſed by the Liburnians in their ſea-rovings or piracies, for which they were noted. *Liburnum* (Juvenal) was a ſpecies of litter made in form of Liburnian ſkiffs, wherein the noblemen of Rome were carried, and where they ſat at their eaſe, either reading or writing.

LIBURNUS (anc. geog.), a mountain of Campania. Alſo a port of Tuſcany. Now *Livorno*, or *Leghorn*. E. Long. 11. N. Lat. 43. 30.

LIBYA, in general, according to the Greeks, denoted Africa. An appellation derived from *lub* "thirſt," being a dry and thirſty country. See AFRICA.

LIBYA, in a more reſtrained ſenſe, was the middle part of Africa, extending north and weſt, (Pliny); between the Mediterranean to the north, and Ethiopia to the eaſt; and was two-fold, the *Hither* or *Exterior Libya*; and the *Farther* or *Interior*. The former lay between the Mediterranean on the north, and the *Farther Libya* and Ethiopia beyond Egypt on the ſouth, (Ptolemy). The *Farther* or *Interior Libya*, was a vaſt country, lying between the *Hither Libya* on the north, the Atlantic ocean on the weſt, the Ethiopic on the ſouth, and Ethiopia beyond Egypt on the eaſt, (Ptolemy).

LIBYA, in a ſtill more reſtrained ſenſe, called, for diſtinction's ſake, *Libya Propria*, was a northern diſtrict of Africa, and a part of the *Hither Libya*; ſituated between Egypt to the eaſt, the Mediterranean to the north, the Syrtis Major and the Regio Tripolitana to the weſt, the Garamantes and Ethiopia beyond Egypt to the South. Now the kingdom and deſart of *Barca*. This Libya was again ſubdivided into *Libya* taken in the ſtricteſt ſenſe of all, and into Marmarica and Cyrenaica. *Libya* in the ſtricteſt ſenſe, otherwiſe the *Exterior*, was the moſt eaſtern part of *Libya Propria*, next to Egypt, with Marmarica on the weſt, the Me-

Mediterranean on the north, and the Nubi, now called *Nubia*, to the ſouth, (Ptolemy).

LICENCE, in law, an authority given to a perſon to do ſome lawful act.

LICENSER *of the Preſs*. See LIBERTY *of the Preſs*.

LICENTIATE, one who has obtained the degree of a licence.—The greateſt number of the officers of juſtice in Spain are diſtinguiſhed by no other title than that of *licentiate*. In order to paſs *licentiate* in common law, civil law, and phyſic, they muſt have ſtudied ſeven years, and in divinity ten. Among us a *licentiate* uſually means a phyſician who has a licence to practice, granted by the college of phyſicians.

LICETUS, a celebrated phyſician of Italy, was born at Rappolo, in the ſtate of Genoa, 1577. He came, it ſeems, into the world, before his mother had completed the ſeventh month of her pregnancy; but his father being an ingenious phyſician, wrapped him up in cotton, and nurtured him ſo that he lived to be 77 years of age. He was trained with great care, and became a very diſtinguiſhed man in his profeſſion; and was the author of a great number of works: his book *De Monſtris* every body muſt have heard of. He was profeſſor of philoſophy and phyſic at Padua, where he died in 1655.

LICHEN, LIVER WORT, in botany; a genus of the natural order of algæ, belonging to the criptogamia claſs of plants. The male receptacle is roundiſh ſomewhat plain and ſhining. In the female the leaves have a farina or mealy ſubſtance ſcattered over them. There are about 120 ſpecies, all found in Britain. Among the moſt remarkable are the following :

1. The geographicus; it is frequent in rocks, and may be readily diſtinguiſhed at a diſtance. The cruſt or ground is of a bright greeniſh-yellow colour, ſprinkled over with numerous plain black tubercles ; which frequently run into one another, and form lines reſembling the rivers in a map, from which laſt circumſtance it takes its name.

2. The calcarious, or black nobbed dyer's lichen, is freqent on calcarious rocks; and hath a hard, ſmooth, white, ſtony, or tartareous cruſt cracked or teſſelated on the ſurface, with black tubercles. Dillenius relates, that this ſpecies is uſed in dyeing, in the ſame manner as *the tartareus* after mentioned.

3. The ventoſus, or red ſpangled tartareous lichen, hath a hard tartareous cruſt, cracked and teſſelated on the ſurface, of pale a yellow colour when freſh, and a light olive when dry. The tubercles are of a blood-red colour at top, their margin and baſe of the ſame colour as the cruſt. The texture and apearance of this (according to Mr Lightfoot), indicate that it would anſwer the purpoſes of dyeing as well as ſome others of this tribe, if proper experiments were made.

4. The candelarius, or yellow farinaceous lichen, is common upon walls, rocks, boards, and old pales. There are two varieties. The firſt has a farinaceous cruſt of no regular figure, covered with numerous, ſmall greeniſh yellow, or olive ſhields, and grows commonly upon old boards. The other has a ſmooth, hard circular cruſt, wrinkled and lobed at the circumference which adheres cloſely to rocks and ſtones. In the centre are numerous ſhields of a deeper yellow or orange colour, which as they grow old, ſwell in the middle, and aſſume the figure of tubercles. The inhabitants of Smaland in Sweden ſcrape this lichen from the rocks, and mix it with their tallow, to make golden candles to burn on feſtival days.

5. The tartarius, or large yellow-ſaucer'd dyer's lichen, is frequent on rocks, both in the Highlands and lowlands of Scotland. The cruſt is thick and tough, either white or greeniſh-white, and has a rough warted ſurface. The ſhields are yellow or buff-coloured, of various ſizes from that of a pins head to the diameter of a ſilver penny. Their margins are of the ſame colour as the cruſt. This lichen is much uſed by the Highlanders for dying a fine claret or pompadour colour. For this purpoſe, after ſcraping it from the rocks, and cleaning it, they ſteep it in urine for a quarter of a year. Then taking it out they make it into cakes, and hang them up in bags to dry. Theſe cakes are afterwards pulveriſed, and the powder is uſed to impart the colour with an addition of alum.

6. The parellus, or crawfiſh-eye lichen, grows upon walls and rocks, but is not very common. The cruſts ſpread cloſely upon the place where they grow; and cover them to a conſiderable extent. They are rough tartareous, and aſh-coloured, of a tough coriaceous ſubſtance. The ſhields are numerous and crowded, having white or aſh coloured, ſhallow, plain diſcs, with obtuſe margins. This is uſed by the French for dyeing a red colour.

7. The ſaxatilis, or grey-blue pitted lichen, is very common upon trunks of trees, rocks, tile, and old wood. It forms a circle two or three inches diameter. The upper ſurface is of a blue grey and ſometimes of a whitiſh aſh-colour, uneven, and full of numerous ſmall pits or cavities; the under ſide is black, and covered all over, even to the edges, with ſhort ſimple hairs or radicles. A variety ſometimes occurs with leaves tinged of a red or purple colour. This is uſed by finches and other ſmall birds in conſtructing the outſide of their curiouſly formed neſts.

8. The omphalodes, or dark coloured dyers lichen is frequent upon rocks. It forms a thick widely expanded cruſt of no regular figure, compoſed of numerous imbricated leaves of a brown or dark purple colour divided into ſmall ſegments. The margins of the ſhields are a little criſped and turned inwards, and their outſide aſh-coloured. The lichen is much uſed by the Highlanders in dyeing a reddiſh brown colour. They ſteep it in urine for a conſiderable time, till it becomes ſoft and like a paſte ; then, forming the paſte into cakes, they dry them in the ſun, and preſerve them for uſe in the manner already related of the tartarius.

9. The parietinus, or common yellow wall-lichen, is very common upon walls, rocks, tiles of houſes, and trunks of trees. It generally ſpreads itſelf in circles of two or three inches diameter, and is ſaid to dye a good yellow or orange colour with alum.

10. The iſlandicus, or eatable Iceland lichen, grows on many mountains both of the Highlands and Lowlands of Scotland. It conſiſts of nearly erect leaves about two inches high, of a ſtiff ſubſtance when dry, but ſoft and pliant when moiſt, variouſly divided without order into broad diſtant ſegments, bifid or trifid at the extremities. The upper or interior ſurface of the leaves is concave, cheſnut-colour, ſmooth and ſhining, but red at the baſe; the under or exterior ſurface is ſmooth and whitiſh, a little pitted and ſprinkled with very minute black warts. The margins of the leaves and all the ſegments from bottom to top are ciliated with ſmall,

ſhort, ſtiff, hair-like ſpinules, of a dark cheſnut colour, turning towards the upper ſide. The ſhields are very rarely produced. For the uſes of this as an eſculent herb, ſee ICELAND, n° 10. Made into broth or gruel, it is ſaid to be very ſerviceable in coughs and conſumptions; and, according to Haller and Scopoli, is much uſed in theſe complaints in Vienna.

11. The pulmonarius, or lung-wort lichen grows in ſhady woods upon the trunks of old trees. The leaves are as broad as a man's hand, of a kind of leather-like ſubſtance, hanging looſe from the trunk on which it grows, and laciniated into wide angular ſegments. Their natural colour, when freſh, is green; but in drying, they turn firſt to a glaucous and afterwards to a fuſcous colour. It has an aſtringent, bitter taſte; and, according to Gmelin, is boiled in ale in Siberia, inſtead of hops. The ancients uſed it in coughs and aſthmas, &c. but it is not uſed in modern practice.

12. The calicaris, or beaked lichen, grows ſometimes upon trees, but more frequently upon rocks, eſpecially on the ſea-coaſts, but is not very common. It is ſmooth, gloſſy, and whitiſh, producing flat or convex ſhields, of the ſame colour as the leaves, very near the ſummits of the ſegments, which are acute and rigid, and, being often reflected from the perpendicular by the growth of the ſhields, appear from under their limbs like a hooked beak. This will dye a red colour; and promiſes, in that intention, to rival the famous *Lichen Rocella* or *Argol*, which is brought from the Canary Iſlands and ſometimes ſold at the price of 80 l. per ton. It was formerly uſed inſtead of ſtarch to make hair-powder.

13. The prunaſtri, or common ragged hoary lichen, grows upon all ſorts of trees; but it is generally moſt white and hoary on the ſloe and old palm trees, or upon old pales. This is the moſt variable of the whole tribe of lichens, appearing different in figure, magnitude and colour, according to its age, place of growth, and ſex. The young plants are of a glaucous colour, ſlightly divided into ſmall acute creſted ſegments. As they grow older, they are divided like a ſtag's horn, into more and deeper ſegments, ſomewhat broad, flat, ſoft, and pitted on both ſides, the upper ſurface of a glaucous colour the under one white and hoary.—The *male* plants, as Linnæus terms them, are ſhort, ſeldom more than an inch high, not hoary on the under ſide; and have pale glaucous ſhields ſituated at the extremities of the ſegments, ſtanding on ſhort peduncles, which are only ſmall ſtiff portions of the leaf produced.—The female ſpecimens have numerous farinaceous tubercles both on the edges of their leaves, and the wrinkles of their ſurface.—The pulveriſed leaves have been uſed as a powder for the hair, and alſo in dyeing yarn of a red colour.

14. The juniperinus, or common yellow tree-lichen is common upon the trunks and branches of elms and many other trees. Linnæus ſays it is very common upon the juniper. The Gothland Swedes dye their yarn of a yellow colour with it, and give it as a ſpecific in the jaundice.

15. The caninus, or aſh-coloured ground-liverwort, grows upon the ground among moſs, at the roots of trees in ſhady woods, and is frequent alſo in heaths and ſtony places. The leaves are large gradually dilated towards the extremities, and divided into roundiſh elevated lobes. Their upper ſide, in dry weather is aſh-coloured; in rainy weather, of a dull fuſcous green colour; their under-ſide white and hoary, having many thick downy nerves, from which deſcend numerous, long, white, pencil-like radicles. The peltæ, or ſhields grow at the extremities of the elevated lobes, ſhaped like the human nail; of a roundiſh oval form, convex above, and concave beneath; of a chocolate colour on the upper ſide, and the ſame colour with the leaves on the under. There are two varieties, the one called *reddiſh*, and the other *many-fingered*, ground-liverwort. The former is more common than the other. This ſpecies has been rendered famous by the celebrated Dr Mead, who aſſerted that it was an infallible preventative of the dreadful conſequences attending the bite of a mad dog. He directed half an ounce of the leaves dried and pulveriſed to be mixed with two drachms of powdered black pepper. This was to be divided into four doſes, one of which was to be taken by the patient every morning faſting, for four mornings ſucceſſively, in half a pint of warm cow's milk; after which he was to uſe the cold bath every morning for a month. It is much to be lamented, however, that the ſucceſs of this medicine, or indeed any other recommended for the ſame purpoſe, has not always anſwered the expectation. There are inſtances where the application has not prevented the hydrophobia, and it is even uncertain whether it has ever been inſtrumental in keeping off that diſorder.

16. The aphthoſus, or green ground liverwort with black warts, grows upon the ground at the roots of trees in woods, and other ſtoney and moſſy places. It differs very little from the foregoing, and according to ſome is only a variety of it. Linnæus informs us, that the country people of Upland in Sweden give an infuſion of this lichen in milk to children that are troubled with the diſorder called the *thruſh* or *apthæ*, which induced that ingenious naturaliſt to beſtow upon it the trivial name of *apthoſus*. The ſame writer alſo tells us that a decoction of it in water purges upwards and downwards, and will deſtroy worms.

17. The cocciferus, or ſcarlet-tipped cup lichen, is frequent in moors and heaths. It has in the firſt ſtate a granulated cruſt for its ground, which is afterwards turned into ſmall laciniated leaves, green above, and hoary underneath. The plant aſſumes a very different aſpect, according to the age, ſituation, and other accidents of its growth; but may be in general readily diſtinguiſhed by its fructifications, which are fungous tubercles of a fine ſcarlet colour, placed on the rim of the cup, or on the top of the ſtalk. Theſe tubercles, ſteeped in an alcaline lixivium, are ſaid to dye a fine durable red colour.

18. The rangiferinus, or rein-deer lichen is frequent in woods, heaths, and mountainous places. Its general height, when full grown, is about two inches. The ſtalk is hollow, and very much branched from bottom to top; the branches are divided and ſubdivided, and at laſt terminated by two, three, four, or five very fine, ſhort, nodding horns. The axillæ of the branches are often perforated. The whole plant is of a hoary white or grey colour, covered with white farinaceous particles, light and brittle when dry, ſoft and elaſtic when moiſt. The fructifications are very minute, round, fuſcous, or reddiſh brown tubercles, which grow on the very extremities of the fineſt branches: but theſe

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tubercles are very ſeldom found. The plant ſeems to have no foliaceous ground for the baſe, nor ſcarcely any viſible roots.—Linnæus tells us, that in Lapland this moſs grows ſo luxuriant that it is ſometimes found a foot high. There are many varieties of this ſpecies, of which the principal is the ſylvaticus, or browntipt rein-deer lichen. The moſt remarkable difference between them is, that the ſylvaticus turns fuſcous by age, while the other always continues white. For the uſes of theſe ſpecies, ſee Lapland.

19. The plicatus, or officinal ſtringy lichen, grows on the branches of old trees, but is not very common. The ſtalks are a foot or more in length, cylindrical, rigid, and ſtring-ſhaped, very irregularly branched, the branches entangled together, of a cinerous or aſh-colour, brittle and ſtringy if doubled ſhort, otherwiſe tough and pliant, and hang pendent from the trees on which they grow. The ſhields grow generally at the extremities of the branches, are nearly flat, or ſlightly concave, thin, aſh coloured above, pale-brown underneath, and radiated with fine rigid fibres. As the plant grows old, the branches become covered with a white, rough, warty cruſt; but the young ones are deſtitute of it. It was formerly uſed in the ſhops as an aſtringent to ſtop hæmorrhagies, and to cure ruptures; but is out of the modern practice. Linnæus informs us, that the Laplanders apply it to their feet to relieve the excoriations occaſioned by much walking.

20. The barbatus, or bearded lichen, grows upon the branches of old trees in thick woods and pine-foreſts. The ſtalks or ſtrings are ſlightly branched and pendulous, from half a foot to two feet in length, little bigger than a taylor's common ſewing thread; cylindrically jointed towards the baſe; but ſurrounded every where elſe with numerous, horizontal, capillary fibres, either ſimple or ſlightly branched. Their colour is a whitiſh green. This has an aſtringent quality like the preceding. When ſteeped in water, it acquires an orange colour; and according to Dillenius, was uſed in Pennſylvania for dyeing that colour.

21. The vulpinus, or gold-wiry lichen, grows upon the trunks of old trees, but is not very common. It is produced in erect tufts, from half an inch to two inches in height, of a fine yellow or lemon-colour, which readily diſcovers it. The filaments which compoſe it are not cylindrical, but a little compreſſed and uneven in the ſurface, variouſly branched, the angles obtuſe, and the branches ſtraggling and entangled one with another. Linnæus informs us, that the inhabitants of Smaland in Sweden dye their yarn of a yellow colour with this lichen; and the Norwegians deſtroy wolves by ſtuffing dead carcaſes with this moſs reduced to powder, and mixed with pounded glaſs, and ſo expoſing them in the winter-ſeaſon to be devoured by thoſe animals.

LICHFIELD. See Litchfield.

LICHTENBERG, a caſtle of France, in Lower Alſace, and the chief place of a county of the ſame name; ſeated on a rock, near the mountains Voſges, and is looked upon as impregnable. E. Long. 7. 35. N. Lat. 48. 55.

LICHTENBURG, a town of Germany, in the circle of Franconia, and margravate of Cullembach. E. Long. 12. 0. N. Lat. 50. 26.

LICHTENFELS, a town of Germany, in the circle of Frrnconia, and biſhopric of Bamberg, ſeated on the river Mayne, in E. Long. 11. 10. N. Lat. 50. 20.

LICHTENSTEIN, a town of Swiſſerland, in Tockerberg, ſeated on the river Thour. E. Long. 2. 15. N. Lat. 47. 25.

LICHTSTALL, an handſome town of Swiſſerland, in the county of Baſle; ſeated on the river Ergetz. In E. Long. 7. 57. N. Lat. 47. 40.

LICINIUS Stolo, a famous Roman tribune, ſtyled *Stolo* on account of a law he made, while tribune, that no Roman citizen ſhould poſſeſs more than 500 acres of land; alleging that when they occupied more, they could not cultivate it with care, nor pull up the uſeleſs ſhoots (*ſtolones*) that grow from the roots of trees. He is memorable alſo for enacting, that one of the conſuls ſhould always be of a Plebeian family. He lived about 362 B. C.

LICNON, in the Dionyſian ſolemnities, the myſtical van of Bacchus; a thing ſo eſſential to all the ſolemnities of this god, that they could not be duly celebrated without it. See Dionysia.

LICNOPHORI, in the Dionyſian ſolemnity, thoſe who carried the licnon.

LICOLA, or Lago-di-Licola, a lake in the kingdom of Naples, formerly famous for plenty of excellent fiſh; but in the year 1538 an exploſion of a volcano changed one part of it into a mountain of aſhes, and the other into a moraſs. It was anciently known by the name of the Lucrine-lake.

LICONIA, in botany: A genus of the digynia order, belonging to the pentandria claſs of plants. There are five petals inlaid in the pit of the nectarium at its baſe; the capſule is bilocular and ſeed-bearing.

LICTORS, among the Romans, were officers eſtabliſhed by Romulus, who always attended the chief magiſtrates when they appeared in public.

The duty of their office conſiſted in the three following particulars: 1. *Submotio*, or clearing the way for the magiſtrate they attended: this they did by word of mouth; or, if there was occaſion, by uſing the rods they always carried along with them. 2. *Animadverſio*, or cauſing the people to pay the uſual reſpect to the magiſtrate, as to alight, if on horſeback or in a chariot; to riſe up, uncover, make way, and the like. 3. *Prætitio*, or walking before the magiſtrates: this they did not confuſedly, or altogether, nor by two or three abreaſt, but ſingly following one another in a a ſtraight line. They alſo preceded the triumphal car in public triumphs; and it was alſo part of their office to arreſt criminals, and to be public executioners in beheading, &c. Their enſigns were the fasces and securis.

As to the number of lictors allowed each magiſtrate, a dictator had twenty-four, a maſter of the horſe ſix, a conſul twelve, a prætor ſix; and each veſtal virgin, when ſhe appeared abroad, had one.

LIDD. See Lydd.

LIDDEL (Dr Duncan), profeſſor of mathematics and of medicine in the univerſity of Helmſtadt, was born in the year 1561 at Aberdeen, where he received the firſt part of his education in languages and philoſophy. About the age of eighteen he repaired to the univerſity of Francfort, where he ſpent three years in a diligent application to mathematics and philoſophy. From Francfort he proceeded to Wratiſlaw, or Breſlaw in Sileſia, where he he is ſaid to have made uncommon progreſs in his favourite ſtudy of mathematics, under the direction of a very eminent profeſſor, Paulus Wittichius. Having ſtudied at Breſlaw for the ſpace of one year, he returned to Francfort, and remained there three years, paying the moſt intenſe application to the ſtudy of phyſic. A contagious diſtemper having broke out at that place, the ſtudents were diſperſed; and Liddel retired to the univerſity of Roſtock. Here he renewed his ſtudies, rather as a companion than a pupil of the celebrated Brucæus, who, though an excellent mathematician, did not ſcruple to confeſs that he was inſtructed by Liddel in the more perfect knowledge of the Copernican ſyſtem, and other aſtronomical queſtions. In 1590 he returned once more to Francfort. But having there heard of the increaſing reputation of the Academia Julia, eſtabliſhed at Helmſtadt by Henry duke of Brunſwick, Mr Liddel removed thither; and ſoon after his arrival was appointed to the firſt or lower profeſſorſhip of mathematics. From thence he was promoted to the ſecond and more dignified mathematical chair, which he occupied for nine years, with much credit to himſelf and to the Julian Academy. In 1596 he obtained the degree of M. D. was admitted a member of that faculty, and began publicly to teach phyſic. By his teaching and his writings he was the chief ſupport of the medical ſchool at Helmſtadt; was employed as firſt phyſician at the court of Brunſwick, and had much practice among the principal inhabitants of that country. Having been ſeveral times elected dean of the faculties both of philoſophy and phyſic, he had in the year 1604 the honour of being choſen pro-rector of the univerſity. But neither academical honours, nor the profits of an extenſive practice abroad, could make Dr Liddel forget his native country. In the year 1600 he took a final leave of the Academia Julia; and after travelling for ſome time through Germany and Italy, he at length ſettled in Scotland. He died in 1613, in the fifty-ſecond year of his age. By his laſt will he beſtowed certain lands purchaſed by him near Aberdeen upon the univerſity there, in all time coming, for the education and ſupport of ſix poor ſcholars. Among a variety of regulations and injunctions for the management of this charity, he appoints the magiſtrates of Aberdeen his truſtees, and ſolemnly denounces the curſe of God on any perſon who ſhould abuſe or miſapply it. His works are, 1. *Diſputationes Medicinales, Helmſtadt*, 1603. 4to. 2. *Ars Medica ſuccincte et perſpicue explicata, Hamburghi*, 1607, 8vo. This performance is dedicated to king James VI. and is divided into five books, viz. *Introductio in totam Medicinam; De Phyſiologia; De Pathologia*; *Signonem doctrina*; *De Therapeutica*. 3. *De Febribus Libri tres, Hamburghi*, 1610, 12mo. 4. *Tractatus de dente aureo, Hamburghi*, 1628, 12mo. This laſt performance Dr Liddel publiſhed in order to refute a ridiculous ſtory then current of a poor boy in Sileſia, who, at ſeven years of age, having loſt ſome of his teeth, brought forth, to the aſtoniſhment of his parents, a new tooth of pure gold. Jacobus Horſtius, doctor and profeſſor of medicine in the *Academia Julia*, at the ſame time with our author, had publiſhed a book which he dedicated to the emperor Rudolphus II. to prove that this wonderful tooth was a prodigy ſent from heaven to encourage the Germans then at war with the Turks, and foretelling, from this golden tooth, the future victories of the Chriſtians, with the final deſtruction of the Turkiſh empire and Mahommetan faith, and a return of the golden age in 1700, preparatory to the end of the world. The impoſture was ſoon after diſcovered to be a thin plate of gold, ſkilfully drawn over the natural tooth by an artiſt of that country, with a view to excite the public admiration and charity. 5. *Artis conſervandi Sanitatem, libri duo, Aberdoniæ*, 1651, 12mo.; a poſthumous work. The merit of theſe works of Dr Liddel, it is not now neceſſary to eſtimate with preciſion. They appear, however, to contain the moſt faſhionable opinions and practice, in the medical art, of the age in which he lived; nor is there almoſt any diſeaſe or medical ſubject then known of which he has not treated in one or other of his writings. Of his language it may be ſufficient to obſerve, that the Latin is at leaſt as pure as is generally found among medical writers, and that his ſtyle is plain and perſpicuous, and ſometimes even elegant.

LIDFORD, a village of Devonſhire in England, ſituated on the river Lid, two or three miles eaſt of Brent Tor, was formerly a famous town, with a caſtle, which was always committed to men of quality, and twice ſent burgeſſes to parliament. It was ſadly ſhattered by the Danes in 997: and though now a contemptible village, the pariſh may for lands and liberties compare with any in the kingdom, the whole foreſt of Dartmore being in the verge of it. The river here being pent up at the bridge with rocks, has made itſelf ſo deep a fall, by its continual working, that paſſengers only hear the noiſe of the water without ſeeing it.

LIDKOPING, a town of Weſt Gothland in Sweden, ſeated on the lake Wenar. in E. Long. 13. 40. N. Lat. 58. 25.

LIDNEY, a town of Glouceſterſhire in England, 71 miles from London, is ſeated on the weſt bank of the river Severn, and has a market on Wedneſdays, with two fairs in the year. In the neighbourhood are the remains of a large Roman encampment, with foundations of many ancient buildings, among which are the ruins of a Roman hypocauſt of an oval form, and Roman antiquities and coins are often found here in great number. Mr Bathurſt has a fine ſeat here called *Sydney-Park*, with very extenſive woods adjoining.

LIE, in morals, denotes a criminal breach of veracity.—Archdeacon Paley, in treating of this ſubject, obſerves, that there are falſehoods which are not lies; that is, which are not criminal: and there are lies which are not literally and directly falſe.

I. Caſes of the firſt claſs are thoſe, 1. Where no one is deceived: as for inſtance in parables, fables, novels, jeſts, tales to create mirth, or ludicrous embelliſhments of a ſtory, in which the declared deſign of the ſpeaker is not to inform, but to divert; compliments in the ſubſcription of a letter; a priſoner's pleading not guilty; an advocate aſſerting the juſtice, or his belief of the juſtice, of his client's cauſe. In ſuch inſtances no confidence is deſtroyed, becauſe none was repoſed; no promiſe to ſpeak the truth is violated, becauſe none was given or underſtood to be given. 2. Where the perſon you ſpeak to has no right to know the truth, or more properly where little or no inconveniency reſults from the want of confidence in ſuch caſes; as where you tell a falſehood to a madman for his own advantage; to a robber to conceal your property; to an aſſaſſin to defeat or to divert him from his purpoſe. It is upon this principle, that, by the laws of war, it is allowed to deceive an enemy by feints, falſe colours, ſpies, falſe intelligence, and the like ; but, by no means, in treaties, truces, ſignals, of capitulation, or ſurrender : and the difference is, that the former ſuppoſe hoſtilities to continue, the latter are calculated to terminate or ſuſpend them.

Many people indulge in ſerious diſcourſe a habit of fiction and exaggeration, in the accounts they give of themſelves, of their acquaintance, or of the extraordinary things which they have ſeen or heard ; and ſo long as the facts they relate are indifferent, and their narratives though falſe are inoffenſive, it may ſeem a ſuperſtitious regard to truth to cenſure them merely for truth's ſake. Yet the practice ought to be checked : for, in the firſt place, it is almoſt impoſſible to pronounce beforehand, with certainty, concerning any lie, that it is inoffenſive ; or to ſay what ill conſequences may reſult from a lie apparently inoffenſive : And, in the next place, the habit, when once formed, is eaſily extended to ſerve the deſigns of malice or intereſt ; like all habits, it ſpreads indeed of itſelf. Pious frauds, as they are improperly enough called, pretended inſpirations, forged books, counterfeit miracles, are impoſitions of a more ſerious nature. It is poſſible that they may ſometimes, though ſeldom have been ſet up and encouraged with a deſign to do good : but the good they aim at requires, that the belief of them ſhould be perpetual, which is hardly poſſible ; and the detection of the fraud is ſure to diſparage the credit of all pretenſions of the ſame nature. Chriſtianity has ſuffered more injury from this cauſe than from all other cauſes put together.

II. As there may be falſehoods which are not lies, ſo there may be lies without literal or direct falſehood. An opening is always left for this ſpecies of prevarication, when the literal and grammatical ſignification of a ſentence is different from the popular and cuſtomary meaning. It is the wilful deceit that makes the lie ; and we wilfully deceive, when our expreſſions are not true, in the ſenſe in which we believe the hearer apprehends them. Beſides, it is abſurd to contend for any ſenſe of words, in oppoſition to uſage ; for all ſenſes of all words are founded upon uſage, and upon nothing elſe. Or a man may act a lie ; as by pointing his finger in a wrong direction, when a traveller inquires of him his road ; or when a tradeſman ſhuts up his windows, to induce his creditors to believe that he is abroad : for to all moral purpoſes, and therefore as to veracity, ſpeech and action are the ſame ; ſpeech being only a mode of action.

LIECHTENAU, a town of Germany, in the circle of Franconia and margravate of Anſpach, ſubject to Nurenburg. E. Long. 9. 5. N. Lat. 48. 43.

LIEGE (*Ligius*,) in law, properly ſignifies a vaſſal, who holds a kind of fee, that binds him in a cloſer obligation to his lord than other people.

The term ſeems to be derived from the French *lier* "to bind ;" on account of a ceremony uſed in rendering faith or homage : which was by locking the vaſſal's thumb or his hand in that of the lord, to ſhow that he was faſt bound by his oath of fidelity. Cujas, Vigenere, and Bignon, chooſe rather to derive the word from the ſame ſource with *leudis* or *leodi*, " loyal, faithful." But Du Cange falls in with the opinion of thoſe who derive it from *liti*, a kind of vaſſals, ſo firmly attached to their lord, on account of lands or fees held of him, that they were obliged to do him all manner of ſervice, as if they were his domeſtics. He adds, this was formerly called *litgium ſervitium*, and the perſon *litge*. In this ſenſe, the word is uſed, Leg. Edw. cap. 29. *Judæi ſub tutela regis ligea debent eſſe* ; that is, wholly under his protection.

By liege homage, the vaſſal was obliged to ſerve his lord towards all, and againſt all, excepting his father. In which ſenſe, the word was uſed in oppoſition to ſimple homage ; which laſt only obliged the vaſſal to pay the rights and accuſtomed dues to his lord ; and not to bear arms againſt the emperor, prince, or other ſuperior lord : ſo that a liege man was a perſon wholly devoted to his lord, and entirely under his command. *Omnibus, &c. Reginaldus, rex Inſularum, ſalutem. Sciatis quod deveni homo ligeus domini regis, Angliæ Johannis, contra omnes mortales, quamdiu vixero ; & in de fidelitatem & ſacramentum præſtiti, &c.* MS. penes W. Dugdale.

But it muſt be obſerved, there were formerly two kinds of liege homage : the one, by which the vaſſal was obliged to ſerve his lord, againſt all, without exception even of his ſovereign ; the other, by which he was to ſerve him againſt all, except ſuch other lords as he had formerly owed liege homage to.

In the old ſtatutes lieges, and liege people, are terms peculiarly appropriated to the king's ſubjects ; as being *liges*, *ligi*, or *ligati*, obliged to pay allegiance to him ; 8 Henry VI. 14. Hen. VIII. &c. though private perſons had their lieges too. *Reinaldus, Dei gratia, abbas Rameſiæ, præpoſito & hominibus de Branceſtre, & omnibus vicinis Francis & Anglis, ſalutem. Sciatis me dediſſe terram Ulfe, in depedene (hodie depedale) huic Boſelino, & uxori ejus Alſniæ—ea conditione quod effecti ſint homines leges.* Lib. Rameſ.

Liege-Pouſtie, in Scots law, is oppoſed to death-bed ; and ſignifies a perſon's enjoying that ſtate of health in which only he can diſpoſe of his property at pleaſure.

LIEGE, a biſhopric of Germany, in the circle of Weſtphalia ; bounded to the north by Brabant, to the ſouth by Champaigne and Luxemberg, to the eaſt by Limburg and Juliers, and to the weſt by Brabant, Namur, and Hainault. It is very unequal both in length and breadth ; the former being in ſome places above 93 miles, in others not half ſo much ; and the latter in ſome places 45, in others hardly 25. The air here is very temperate ; and the ſoil fruitful in corn, wine, wood, and paſture. Here alſo are mines of lead and iron, pits of coal, quarries of marble and ſtone, and ſome celebrated mineral waters, as thoſe of Spa and Chau-fontaine. The principal rivers are, the Maes and Sambre. The manufactures and commodities of the country are chiefly beer, arms, nails, ſerge, leather, with the products we have juſt mentioned. The ſtates of the biſhopric are compoſed of three bodies : the firſt is the chapter of Liege ; the ſecond, the nobility of the country ; and the third, the deputies of the capital and the other towns. The three eſtates are ſeldom called together, except to raiſe taxes for the ſervice of the province, or upon ſome particular emergency ; but there is a committee of the ſtates, who meet thrice a-week, and in time of war daily. They are always about the prince-biſhop, to make remonſtrances, and demand the redreſs of grievances. The biſhop is ſpiritual and temporal lord of the whole country; but, as biſhop, is ſuffragan to the archbiſhop of Cologne. He ſtyles himſelf, *by the grace of God, biſhop and prince of Liege, duke of Bouillon, marquis of Franchimont, count of Looz, Hoorn,* &c. His arms for Liege are a pillar argent, on a pedeſtal of the ſame, with a crown or, in a field ruby. In the matricula he was formerly rated at 50 horſe and 170 foot; or 1280 florins monthly, in lieu of them, but now only at 826. An abatement of one third has alſo been granted of the ancient aſſeſſment to the chamber-court, which was 360 rix-dollars 62½ kruitzers for each term. Here are ſeveral colleges which ſit at Liege, for the government of the country, and the deciſion of cauſes, civil, criminal, ſpiritual, and feudal, and of ſuch alſo as relate to the finances, the chapter conſiſts of 60 perſons, who muſt either prove their nobility for four generations, both by father and mother, before they can be admitted: or if they cannot do that, muſt at leaſt have been doctors, or licentiates of divinity for ſeven years, or, of law, for five years, in ſome famous univerſity. The biſhopric is very populous and extenſive, containing 1500 pariſhes, in which are 24 walled towns, beſides others, 52 baronies, beſides counties and ſeigniories 17 abbeys for men, who muſt be all gentlemen, and 11 for ladies, excluſive of others.

Liege, the capital of the biſhopric of the ſame name, ſtands upon the Maes, in a fine valley, ſurrounded with woods and hills, being a free imperial city, and one of the largeſt and moſt eminent in Europe. Though it is 100 miles from the ſea by water, the Maes is navigable up to it. The city has 16 gates; 17 bridges, ſome of them very handſome; 154 ſtreets, many of them ſtraight and broad; a fine epiſcopal palace; a very large ſtately cathedral, in which, beſides five great ſilver coffers full of reliques, are ſeveral ſilver ſtatues of ſaints, and a St George on horſeback of maſſy gold, preſented to the cathedral by Charles the Bold, by way of atonement for uſing the inhabitants cruelly in the year 1468. Of the other churches, that of St Paul is the moſt remarkable, both for its ſtructure and fine ornaments in painting and marble. The city is well fortified, and there are alſo two caſtles on the mountain of the Holy Walburg for its defence. Beſides a great number of other convents of both ſexes, here is a college of Engliſh Jeſuits, founded in the year 1616, and a fine nunnery of Engliſh ladies. Indeed, churches, convents, and other religious foundations, take up the greater part of it. The reader, therefore, no doubt, will take it for granted, that it is a moſt bleſſed, holy, and happy city. But however it may fare with the profane, unhallowed laity, it is certainly the paradiſe of prieſts, as it is expreſsly called, by way of eminence. It is divided into the old and new, or the upper and lower; and the latter again into the iſland, and the quarter beyond the Maes. The houſes are high, and built of bluiſh marble. In the town and ſuburbs are 12 public places or ſquares, 10 hoſpitals, a beguin-houſe, and two fine keys, planted with ſeveral rows of trees, for the burghers to take the air; but a great part of that within the walls is taken up with orchards and vineyards. The manufactures of this city are arms, nails leather, ſerge, and beer. In St William's convent, without the city, is the tomb of the famous Engliſh traveller Sir John Mandeville, with an inſcription in barbarous French, requeſting thoſe who read it to pray for his ſoul. Near it are kept the ſaddle, ſpurs, and knife, that he made uſe of in his travels. After having ſeen moſt of the cities of any note in the world, he made choice of this to ſpend the eve of his life in. A little way from the city, on the other ſide the Maes, ſtands the epiſcopal palace of Seraing, in which the biſhops generally reſide during the ſummer. The latitude of this city is 50. 36. N. and the longitude 5. 40. E.

Some diſturbances took place here in the year 1789, in conſequence of certain diſputes that had ariſen between the prince-biſhop and the inhabitants. The latter having demanded certain privileges, which he did not think proper to grant, they took up arms, and compelled him and his chapter to comply with their requeſt. The prince, together with many of the clergy, nobility, and citizens, alarmed by this commotion, and dreading the conſequences of popular fury, which when once rouſed, ſeldom knows any bounds, ſought ſafety by a voluntary exile. They then appealed to the imperial chamber; and this tribunal, inſtead of acting the part of arbiter, decided as a ſovereign, and ordered the circles of the Lower Rhine and Weſtphalia to execute the ſentence.

The king of Pruſſia, at whoſe court one of the chiefs of the inſurrection had reſided, and who wiſhed to gain a party at Liege, became mediator; and ſeemed to favour the Liegoiſe, many of whoſe claims were juſt, though they attempted to enforce them by violence and the moſt illegal ſteps. Intoxicated with this protection, the people of Liege treated the remonſtrances of their biſhop, the decrees of the imperial chamber, and the reſolutions of the directory of the two circles, with the utmoſt contempt; and proceeded ſo far as even to dethrone their prince, by appointing a regent in the perſon of a French prelate. The electoral college having deliberated on the beſt means of putting an end to theſe diſturbances, its propoſitions, though modified by M. Dohm the Pruſſian plenipotentiary, made the inſurgents break out into open ſedition. Deluded by their leaders, they gave themſelves up every day to new exceſſes; the effects of the citizens were expoſed to pillage, and their perſons to inſult. The king of Pruſſia, who was deſirous to bring matters to an accommodation, and not to inſtigate the Liegoiſe to become independent, finding that the efforts of his miniſter were not attended with the deſired ſucceſs, ſeemed unwilling to interfere any farther in an affair which might have led him into a quarrel with the empire. The executive troops, at the ſame time, remained almoſt in a ſtate of inactivity; and ſeemed rather to guard the frontiers of this petty ſtate, than to make any attempt to reduce it to obedience. Neither this conduct, however, nor the exhortations of Pruſſia, added to the moral certainty of their being ſoon compelled to lay down their arms, made any change in the conduct of the malcontents. They declared openly, in the face of all Europe, that they would either conquer or die; and they perſiſted in this reſolution, while commerce, manufactures, and the public revenues, were going daily to decay.

Having at length openly attacked the executive forces without the territories of their city, the emperor could no longer remain an indifferent ſpectator. It was

was now full time to put a period to that madneſs to which the people had abandoned themſelves; and to accompliſh this in an effectual manner, the imperial chamber at Wetzlar requeſted the emperor, as a member of the ancient circle of Burgundy, to execute its orders reſpecting this object. In conſequence of this meaſure, Baron Alvinzi, who commanded a body of Auſtrians cantoned in Limburgh and the confines of Brabant, notified, by order of Marſhal Bender, to the ſtates and municipality of Liege, that the emperor intended to ſend troops into their city and territories, for the purpoſe of reſtoring tranquillity and good order. The ſtates had already been informed of this reſolution by their agent at Wetzlar. They therefore wrote to Marſhal Bender, to aſſure him of the reſpectful confidence which they placed in the juſtice and magnanimity of the emperor, and to requeſt that the Auſtrian troops might enter alone, without thoſe of the electors; and that they might be confined to occupy the gates and the ſuburbs only. To this letter, which was carried to Bruſſels by a deputation of the ſtates, Marſhal Bender returned a very ſatisfactory anſwer, relating to the diſpoſition of the electoral troops; but Baron Alvinzi, in a note which he wrote to the ſtates, inſiſted among other articles, that all the citizens ſhould throw down their arms: that proper accommodations ſhould be prepared for the officers and men; that the warlike ſtores, collected for making reſiſtance, ſhould be removed; and that cockades, and every other diſtinctive mark of the like kind, ſhould be laid aſide before the arrival of the Imperial troops. However humiliating theſe preliminaries might be, eſpecially that of a general diſarming, the ſtates and muncipalities acquieſced without the leaſt reſerve; and their ſubmiſſion, as ſudden as complete, was communicated to the people, with an exhortation to follow their example.

Notwithſtanding this pacific appearance, two days before the entrance of the Imperial troops, the municipal council of Liege, flattering themſelves, perhaps, with the hopes of aſſiſtance from Pruſſia, aſſured the inhabitants that they would remain unſhaken in their poſt, and that they had ſworn never to deſert the cauſe in which they were engaged. This, however, did not prevent the Auſtrian troops, to the number of 6000, from penetrating, without oppoſition, into the heart of the city; where they occupied every poſt; made the citizens lay aſide their arms,, uniforms, and cockades; and, in a ſingle hour, dethroned ſo many ſovereigns of a year. The greater part of the municipal officers, who, two days before, had ſolemnly promiſed ſuch great things; betook themſelves to flight, and retired either to France or Weſel; while the ancient magiſtracy, which had been expelled in the month of Auguſt 1789, was proviſionally reinſtated by the directorial commiſſioners.—The decrees of the imperial chamber at Wetzlar have ſince been executed in their utmoſt extent. The ancient magiſtracy and the privy-council of the prince biſhop have been reſtored; and the prince himſelf having returned, peace and good order have been re-eſtabliſhed.

LIENTERY, a flux of the belly, in which the aliments are diſcharged as they are ſwallowed, or very little altered either in colour or ſubſtance. See (*Index* ſubjoined to) MEDICINE.

LIEVENS (John or Jan), a celebrated painter, was born at Leyden in 1607. He diſcovered an early inclination for the arts, and was the diſciple firſt of Joris van Schooten, and afterwards of Peter Laſtman. He excelled principally in painting portraits; but he alſo executed ſeveral hiſtorical ſubjects with great ſucceſs. He came over into England, where he reſided three years, and painted the portraits of Charles I. the queen, the prince of Wales, and ſeveral of the nobility; after which he returned to Antwerp, where he met with full employment for his pencil. We have ſeveral etchings by this maſter, which are performed in a ſlight, but maſterly manner. The chiaro ſcuro is very ſkilfully managed in them, ſo as to produce a moſt powerful effect. His ſtyle of etching bears ſome reſemblance to that of Rembrandt; but it is coarſer in general, and leſs finiſhed.

LIEOU-KIEOU, the name of certain iſlands of Aſia, ſubject to China; but hitherto little known to geographers, who have been ſatisfied with marking their exiſtence and latitude in their charts. They, however, form a powerful and extenſive empire, the inhabitants of which are civilized, and ought not to be confounded with other ſavage nations diſperſed throughout the iſlands of Aſia. Father Gabil, a Jeſuit, has furniſhed us with ſome intereſting details reſpecting theſe iſlanders, which he extracted from a Chineſe relation, publiſhed in 1721, at the end of a voyage that was undertaken on the following account. The emperor Kang-hi having reſolved, in 1719, to ſend an ambaſſador to the king of Lieou-kieou, choſe for this purpoſe one of the great doctors of the empire, named *Supao-Koang*. This learned man departed from China in 1719, and returned to Peking in 1720, where, in the year following, he cauſed a relation of his voyage to be publiſhed in two volumes. It is in the firſt of theſe that he gives an accurate and particular deſcription of the iſles of Lieou-kieou; and what he relates appears to be worthy of the greater credit, becauſe, being on the ſpot, he examined, as he himſelf ſays, according to the orders of the emperor, whatever he found curious or intereſting, reſpecting the number, ſituation, and productions of theſe iſles; as alſo the hiſtory, religion, manners, and cuſtoms of the people who inhabit them.

Theſe iſles, ſituated between Corea, Formoſa, and Japan, are in number 36. The principal and largeſt is called *Lieou-kieou*; the reſt have each a particular denomination. The largeſt iſland extends from north to ſouth almoſt 440 lys, and 120 or 140 from eaſt to weſt; but on the ſouth ſide, the extent from eaſt to weſt is not 100 lys. The ſouth-eaſt part of the iſland where the court reſides, is called *Cheouli*; and it is there that Kint-ching, the capital city, is ſituated. The king's palace, which is reckoned to be four leagues in circumference, is built on a neighbouring mountain. It has four gates, which correſpond to the four cardinal points; and that which fronts the weſt forms the grand entry. The view which this palace commands is moſt extenſive and delightful; it reaches as far as the port of Napakiang, at the diſtance of ten lys, to the city of Kint-ching, and to a great number of other cities, towns, villages, palaces, temples, monaſteries, gardens, and pleaſure houſes. It ſtands in longitude 146° 26′ eaſt, and in latitude 26° 2′ north.

If we believe theſe iſlanders, the origin of their empire is loſt in the remoteſt antiquity. They reckon up 25 ſucceſſive dynaſties, the duration of which forms a period of more than 18,000 years. It would be uſeleſs to employ a ſingle moment in pointing out the abſurdity of theſe pretenſions. It is however certain, that the exiſtence of the country called *Lieou kieou* was not known in China before the year 605 of the Chriſtian æra. It was in the courſe of that year, that one of the emperors of the dynaſty of Soui, having heard of theſe iſles, was deſirous of knowing their ſituation. This prince at firſt ſent ſome Chineſe thither; but their expedition proved fruitleſs, as the want of interpreters prevented them from acquiring that knowledge which was the object of their voyage. They only brought ſome of the iſlanders with them to Sigan-fou, the capital of the province of Chen-ſi, which was the uſual reſidence of the emperors of the dynaſty of Soui. It fortunately happened, that an ambaſſador of the king of Japan was then at court. This ambaſſador and his attendants immediately knew the ſtrangers to be natives of Lieou kieou: but they ſpoke of theſe iſles as of a miſerable and wretched country, the inhabitants of which had never been civilized. The emperor of China afterwards learned, that the principal iſland lay to the eaſt of a city called at preſent *Fou-tcheou-fou*, which is the capital of the province of Fo-kien; and that, in a paſſage of five days, one might reach the large iſland where the king kept his court.

On this information, the emperor Yang-ti ſent ſkilful men, accompanied by interpreters, to ſummon the prince to do homage to the emperor of China, and to pay him tribute. This propoſal was very ill received. The king of Lieou-kieou ſent back the Chineſe, telling them, ſternly, that he acknowledged no prince to be his ſuperior. This anſwer irritated the emperor, who to obtain revenge, cauſed a fleet to be immediately equipped in Fo-kien, in which he embarked 10,000 men. This fleet ſet ſail, and arrived in ſafety at the port of Napa-kiang. The army, in ſpite of every effort made by the natives, landed on the iſland; and the king, who had put himſelf at the head of his troops to oppoſe the enemy, having fallen in battle, the Chineſe pillaged, ſacked, and burnt the royal city, made more than 5000 ſlaves, and returned to China.

The emperors of the dynaſty of Tang, thoſe of the ſhort dynaſties that followed, and thoſe of the dynaſty of Song, although they were fully informed of every thing reſpecting the Lieou-kieou iſles, made no attempts to render them tributary. In 1291, Chi tſou-emperor of the dynaſty of Yven, was deſirous of reviving the pretenſions of his predeceſſors. He fitted out a fleet to ſubdue theſe iſlands: but ſchemes of conqueſt had become diſagreeable to the Chineſe, ſince the diſaſter that befel their army in an expedition againſt Japan. The fleet of Chi-tſou went no farther than the iſles of Pong-hou, and the weſtern coaſt of Formoſa, from whence, under divers pretences, they retured to the ports of Fo-kien.

It was only in 1372, under the reign of Hong-vou, founder of the dynaſty of Ming, that theſe iſlands ſubmitted voluntarily to the Chineſe government. Hong-vou had ſent one of the grandees of his court to Tſay-tou, who was then reigning at Lieou-kieou, to inform him of his acceſſion to the throne. The Chineſe nobleman had received particular inſtructions reſpecting this commiſſion, and he acquitted himſelf of it with all the prudence and addreſs of an able miniſter. In a private audience which he had with Tſay-tou, he exhorted this prince to declare himſelf a tributary of the empire, and laid before him the advantages he would derive from this ſtep. His reaſoning, ſupported by the power of his natural eloquence, made ſo much impreſſion on the mind of Tſay-tou, that he embraced the propoſal made him, and ſent immediately to the emperor to demand the inveſtiture of his ſtates.

Hong-vou received his envoys in a magnificent manner, and loaded them with preſents. He ſolemnly declared Tſay-tou a vaſſal of the empire; and, after having received his firſt tribute (which conſiſted in valuable horſes, aromatic wood, ſulphur, copper, tin, &c.) he ſent to this prince, a golden ſeal, and confirmed the choice he had made of one of his ſons for ſucceſſor. The emperor afterwards ſent 36 families, almoſt all from the province of Fo-kien to Lieou-kieou. Tſay-tou received them, aſſigned them lands near the port of Napa-kiang, and appointed certain revenues for their uſe, at the ſame time that Hong-vou made them conſiderable remittances. Theſe families firſt introduced into Lieou-kieou the learned language of the Chineſe, the uſe of their characters, and the ceremonies practiſed in China in honour of Confucius. On the other hand, the ſons of ſeveral of the grandees of the court of Tſay-tou were ſent to Nan-king, to ſtudy Chineſe in the imperial college, where they were treated with diſtinction, and maintained at the emperors expence.

The iſles of Lieou-kieou had neither iron nor porcelain. Hong-vou ſupplied this want; he cauſed a great number of utenſils of iron and inſtruments to be made, which he ſent thither, together with a quantity of porcelain veſſels. Commerce, navigation, and the arts ſoon began to flouriſh. Theſe iſlanders learned to caſt bells for their temples, to manufacture paper and the fineſt ſtuffs, and to make porcelain, with which they had been ſupplied before from Japan.

The celebrated revolution which placed the Tartars on the imperial throne of China, produced no change in the conduct of the kings of Lieou-kieou. Chang-tché, who was then reigning, ſent ambaſſadors to acknowledge Chun-tchi, and received a ſeal from him, on which were engraved ſome Tartar characters. It was then ſettled, that the king of Lieou-kieou ſhould pay his tribute only every two years, and that the number of perſons in the train of his envoys ſhould not exceed 150.

The emperor Kang-hi ſeemed to pay more attention to theſe iſles than any of his predeceſſors. He cauſed a ſuperb palace to be erected in honour of Confucius, and a college where he maintained maſters to teach the ſciences and the Chineſe characters. He alſo inſtituted examinations for the different degrees of the literati. He ordained, that the king of Lieou-kieou ſhould never ſend in tribute roſe-wood, cloves, or any other production which was not really of the growth of the country; but that he ſhould ſend a fixed quantity of ſulphur, copper, tin, ſhells, and mother of pearl, which is remarkably pretty in theſe iſlands. He permitted, that, beſides the uſual tribute, he might preſent him horſe furniture, piſtol-caſes, and other things of the ſame kind, which theſe iſlanders are ſaid to manufacture with great taſte and neatneſs.

It is more than 900 years ſince the bronzes of China introduced at Lieou-kieou the worſhip of Fo, and the principal books belonging to their ſect. This worſhip is at preſent the eſtabliſhed religion both of the grandees and of the people. There is ſtill to be ſeen in the royal city a magnificent temple, erected in honour of another idol borrowed from the Chineſe, named *Tein-fey*, which ſignifies *celeſtial queen* or *lady*.

Theſe iſlanders do not make promiſes or ſwear before their idols. When they have occaſion to do this, they burn perfumes, preſent fruits, and ſtand reſpectfully before ſome ſtone, which they call to witneſs the ſolemnity of their engagements. Numbers of ſtones are to be ſeen in the courts of their temples, in moſt public places, and upon their mountains, which are entirely appropriated to this purpoſe. They have alſo among them women conſecrated for the worſhip of ſpirits, who are ſuppoſed to have great influence over theſe beings. They viſit the ſick, diſtribute medicines, and recite prayers for their recovery.

They reſpect the dead as much as the Chineſe, and they are no leſs ceremonious in wearing mourning; but their funerals are neither ſo pompous, nor attended with ſo much expence. Their coffins, which are of an hexagonal or octagonal figure, are three or four feet high. They burn the fleſh of the bodies of their dead, and preſerve only the bones. They never offer proviſions to them; they are contented with placing lamps round them, and burning perfumes.

Different families are diſtinguiſhed in Lieou-kieou by ſurnames, as in China; but a man and a woman of the ſame ſurname cannot be united in marriage. The king is not permitted to marry but in the three grand families, which always enjoy the higheſt offices. There is a fourth, of equal diſtinction as the three former; but neither the king nor the princes contract any alliances with this family; for it is doubtful, whether it be not ſprung from the ſame ſtem as the royal line.

A plurality of wives is allowed in theſe iſles. Young men and young women enjoy the liberty of ſeeing one another, and of converſing together; and their union is always in conſequence of their own choice. The women are very reſerved; they never uſe paint, and wear no pendants in their ears; they collect their hair on the top of their heads in the form of a curl, and fix it in that manner by means of long pins made of gold or ſilver.

Beſides the vaſt domains which the king poſſeſſes, he receives the produce of all the ſulphur, copper, and tin-mines, and of the ſalt-pits, together with what ariſes from taxes. From theſe revenues he pays the ſalaries of the mandarins and officers of his court. Theſe ſalaries are eſtimated at a certain number of ſacks of rice; but under this name is comprehended whatever the king gives in grain, rice, ſilk, cloth, &c. The whole is valued according to the price of the ſacks of rice.

There are here, as in China, nine orders of mandarins, who are diſtinguiſhed by the colour of their caps, or by their girdles and cuſhions. The greater part of the titles of theſe mandarins are hereditary in their families; but there are ſome which are only beſtowed upon merit. In the royal city there are tribunals eſtabliſhed for managing the revenue and affairs of the principal iſland, and of all the others which are dependent on it. The latter have agents, who reſide at court. There are alſo particular tribunals for civil and criminal matters; for whatever concerns the families of the grandees and princes; for the affairs of religion; for inſpecting the public granaries, king's revenues, duties; for commerce, manufactures, civil ceremonies, and for navigation, public edifices, literature, and war.

The veſſels that are built in this country are greatly valued by the people of China and Japan. In theſe the natives go not only from one iſland to another, but alſo to China, Tong-king, Cochinchina, Corea, Nangazaki, Satſuma, the neighbouring iſles, and to Formoſa, where they diſpoſe of their different commodities. Beſides thoſe articles of commerce which their manufactures of ſilk, cotton, paper, arms, copper utenſils, &c. furniſh them, they alſo export mother of pearl, tortoiſe and other ſhells, coral and whet-ſtones, which are in great requeſt both in China and Japan.

LIEUTAUD (Dr Joſeph), counſellor of ſtate and firſt phyſician at the court of France, was born at Aix in Provence, and reſided principally there till he took the degree of doctor of medicine. After this he proſecuted his ſtudies for ſome years at Montpelier. He returned to Aix, where he ſoon acquired extenſive practice, and became eminent for literary abilities. He reſided there till the year 1750, when he was invited to act as phyſician to the royal infirmary at Verſailles. There he practiſed with ſuch reputation and ſucceſs, that he ſoon arrived at the head of his profeſſion; and in the year 1774, upon the death of M. Senac, he was appointed archiater. His extenſive engagements in practice did not prevent him from cultivating the ſcience of medicine in all its branches, and from freely communicating to others the reſult of his own ſtudies. He publiſhed many valuable works; amongſt which the following may be accounted the moſt remarkable. 1. *Elementa Philologiæ*. 2. *Precis de la Medicine*. 3. *Pratique Precis de la Matiere Medicale*. 4. *Eſſais Anatomique*. 5. *Synopſis Univerſæ Praxeos Medicinæ*. 6. *Hiſtoria Anatomico-Medica*. He died at Verſailles in 1780, aged 78 years.

LIEUTENANT, an officer who ſupplies the place and diſcharges the office of a ſuperior in his abſence. Of theſe, ſome are civil, as the lords lieutenants of kingdoms, and the lords-lieutenants of counties; and others are military, as the lieutenant-general, lieutenant-colonel, &c.

Lord LIEUTENANT *of Ireland*, is properly a viceroy; and has all the ſtate and grandeur of a king of England, except being ſerved upon the knee. He has the power of making war and peace, of beſtowing all the offices under the government, of dubbing knights, and of pardoning all crimes except high treaſon; he alſo calls and prorogues the parliament, but no bill can paſs without the royal aſſent. He is aſſiſted in his government by a privy-council; and, on his leaving the kingdom, he appoints the lords of the regency, who govern in his abſence.

Lord LIEUTENANTS *of Counties*, are officers, who, upon any invaſion or rebellion, have power to raiſe the militia, and to give commiſſions to colonels and other officers, to arm and form them into regiments, troops, and companies. Under the lord-lieutenants, are deputy-lieutenants, who have the ſame power;

theſe are choſen by the lords-lieutenants, out of the principal gentlemen of each county, and preſented to the king for his approbation.

LIEUTENANT-Colonel. See COLONEL.

LIEUTENANT-General. See GENERAL.

LIEUTENANT, in the land-ſervice, is the ſecond commiſſioned officer in every company of both foot and horſe, and next to the captain, and who takes the command upon the death or abſence of the captain.

LIEUTENANT of Artillery. Each company of artillery hath four: 1 firſt and 3 ſecond lieutenants. The firſt lieutenant hath the ſame detail of duty with the captain; becauſe in his abſence he commands the company: he is to ſee that the ſoldiers are clean and neat; that their clothes, arms, and accoutrements, are in good and ſerviceable order; and to watch over every thing elſe which may contribute to their health. He muſt give attention to their being taught the exerciſe, ſee them punctually paid, their meſſes regularly kept, and to viſit them in the hoſpitals when ſick. He muſt aſſiſt at all parades, &c. He ought to underſtand the doctrine of projectiles and the ſcience of artillery, with the various effects of gun-powder, however managed or directed; to enable him to conſtruct and diſpoſe his batteries to the beſt advantage; to plant his cannon, mortars, and howitzers, ſo as to produce the greateſt annoyance to an enemy. He is to be well ſkilled in the attack and defence of fortified places; and to be converſant in arithmetic, mathematics, mechanics, &c.

Second LIEUTENANT in the Artillery, is the ſame as an enſign in an infantry regiment, being the youngeſt commiſſioned officer in the company, and muſt aſſiſt the firſt lieutenant in the detail of the company's duty. His other qualifications ſhould be equal with thoſe of the firſt lieutenant.

LIEUTENANT of a ſhip of War, the officer next in rank and power to the captain, in whoſe abſence he is accordingly charged with the command of the ſhip, as alſo the execution of whatever orders he may have received from the commander relating to the king's ſervice.

The lieutenant who commands the watch at ſea, keeps a liſt of all the officers and men thereto belonging, in order to muſter them when he judges it expedient, and report to the captain the names of thoſe who are abſent from their duty. During the night-watch, he occaſionally viſits the lower decks, or ſends thither a careful officer, to ſee that the proper centinels are at their duty, and that there is no diſorder amongſt the men; no tobacco ſmoked between decks, nor any fire or candles burning there, except the lights which are in lanthorns, under the care of a proper watch, on particular occaſions. He is expected to be always upon deck in his watch, as well to give the neceſſary orders with regard to trimming the ſails and ſuperintending the navigation, as to prevent any noiſe or confuſion; but he is never to change the ſhip's courſe without the captain's directions, unleſs to avoid an immediate danger.

The lieutenant, in time of battle, is particularly to ſee that all the men are preſent at their quarters, where they have been previouſly ſtationed according to the regulations made by the captain. He orders and exhorts them every where to perform their duty; and acquaints the captain at all other times of the miſbehaviour of any perſon in the ſhip, and of whatever elſe concerns the ſervice or diſcipline.

The youngeſt lieutenant in the ſhip, who is alſo ſtyled *lieutenant at arms,* beſides his common duty, is particularly ordered, by his inſtructions, to train the ſeamen to the uſe of ſmall arms, and frequently to exerciſe and diſcipline them therein. Accordingly his office, in time of battle, is chiefly to direct and attend them; and at all other times to have a due regard to the preſervation of the ſmall arms, that they be not loſt or embezzled, and that they are kept clean and in good condition for ſervice.

LIEUTENANT-Reformed, he whoſe company or troop is broke or diſbanded, but continued in whole or half-pay, and ſtill preſerves his right of ſeniority and rank in the army.

LIFE, is peculiarly uſed to denote the animated ſtate of living creatures, in the time that the union of their ſoul and body laſts.

The Prolongation of LIFE is made by Lord Bacon one of the three branches of medicine; the other two relating to the preſervation of health, and the cure of diſeaſes. See MEDICINE.

The theory of prolonging life he numbers among the deſiderata. Some means or indications that ſeem to lead to it, he lays down as follow.

Things are preſerved in two manners; either in their *identity,* or by *reparation.* In their *identity*; as a fly or ant in amber; a flower, or fruit, or wood, in a conſervatory of ſnow; a dead carcaſe in balſams. By *reparation*; as a flame, or a mechanical engine, &c. To attain to the prolongation of life, both theſe methods muſt be uſed. And hence, according to him, ariſe three intentions for the prolongation of life: *Retardation* of conſumption, proper *reparation,* and *renovation* of what begins to grow old.

Conſumption is occaſioned by two kinds of depredation; a depredation of the innate ſpirit, and a depredation of the ambient air. Theſe may be each prevented two ways; either by rendering thoſe agents leſs predatory, or by rendering the paſſive parts (*viz.* the juices of the body) leſs liable to be preyed on. The ſpirit will be rendered leſs predatory, if either its ſubſtance be condenſed, as by the uſe of opiates, grief, &c.; or its quantity diminiſhed, as in ſpare and monaſtic diets; or its motion calmed, as in idleneſs and tranquillity. The ambient air becomes leſs predatory, if it be either leſs heated by the rays of the ſun, as in cold climates, in caves, mountains, and anchorets cells; or be kept off from the body, as by a denſe ſkin, the feathers of birds, and the uſe of oils and unguents without aromatics. The juices of the body are rendered leſs liable to be preyed on, either by making them harder or more moiſt and oily: harder, as by a coarſe ſharp diet, living in the cold, robuſt exerciſes, and ſome mineral baths: moiſter, as by the uſe of ſweet foods, &c. abſtaining from ſalts and acids; and eſpecially by ſuch a mixture of drink as conſiſts wholly of fine ſubtile particles without any acrimony or acidity.

Reparation is performed by means of aliment; and alimentation is promoted four ways: by the concoction of the viſcera, ſo as to extrude the aliment: By exciting the exterior parts to the attraction of the aliment; as in proper exerciſes and frications, and ſome unctions and baths; By the preparation of the food itſelf, ſo as it may more eaſily inſinuate itſelf, and in ſome meaſure anticipate the digeſtion; as in various ways of dreſſing meats, mixing drinks, fermenting breads, and reducing the virtues of theſe three into one: By promoting the act of aſſimilation itſelf, as in ſeaſonable ſleep, ſome external application, &c.

The *renovation* of what begins to grow old, is performed two ways: By the inteneration of the habit of the body; as in the uſe of emollients, emplaſters, unctions, &c. of ſuch a nature, as do not extract but impreſs: Or by purging off the old juices, and ſubſtituting freſh ones; as in ſeaſonable evacuations, attenuating diets, &c.

The ſame author adds theſe three axioms: That the prolongation of life is to be expected, rather from ſome ſtated diets, than either from any ordinary regimen or any extraordinary medicines; more from operating on the ſpirits and mollifying the parts, than from the manner of feeding; and this mollifying of the parts without is to be performed by ſubſtantials, impriments, and occludents. See LONGEVITY.

Vegetable LIFE. See PLANTS.

LIFE-*Rent*, in Scots law. When the uſe and enjoyment of a ſubject is given to a perſon during his life, it is ſaid to belong to him in life-rent.

LIGAMENT, in its general ſenſe, denotes any thing that ties or binds one part to another.

LIGAMENT, in anatomy, a ſtrong compact ſubſtance, ſerving to join two bones together. See ANATOMY, n° 7.

LIGARIUS (Quintus), a Roman proconſul in Africa, 49 B. C. Taking part with Pompey, he was forbidden by Julius Cæſar to return to Rome; to obtain his pardon, Cicero made that admired oration in his defence which has immortalized the memory of the client with that of his celebrated advocate.

LIGATURE, in ſurgery, is a cord, band, or ſtring; or the binding any part of the body with a cord, band, fillet, &c. whether of leather, linen, or any other matter.

Ligatures are uſed to extend or replace bones that are broken or diſlocated; to tie the patient down in Lithotomy and amputations; to tie upon the veins in phlebotomy, or the arteries in amputations, or in large wounds; to ſecure the ſplints that are applied to fractures; to tie up the proceſſes of the peritoneum with the ſpermatic veſſels in caſtration; and laſtly, in taking off warts, or other excreſcences by ligature.

LIGATURE, is alſo uſed to ſignify a kind of bandage or fillet, tied round the arm, neck, leg, or other part of the bodies of men or beaſts, to divert or drive off ſome diſeaſe, accident, &c.

LIGATURE, is alſo uſed for a ſtate of impotency, in reſpect to venery, pretended to be cauſed by ſome charm or witchcraft.

Kæmpfer tells of an uncommon kind of ligature or knotting, in uſe among the people of Maſſacar, Java, Malaja, Siam; &c. By this charm or ſpell, a man binds up a woman, and a woman a man, ſo as to put it out of their power to have to do with any other perſon; the man being thereby rendered impotent to any other woman, and all other men impotent with the woman.

Some of their philoſophers pretend, that this ligature may be effected by the ſhutting of a lock, the drawing of a knot, or the ſticking of a knife in the wall, at the point of time wherein the prieſt is joining a couple together; and that a ligature, thus effected, may be diſſolved, by the ſpouſe's urining through a ring. This piece of ſuperſtition is ſaid to obtain alſo among the Chriſtians of the Eaſt,

The ſame author tells us, that during the ceremony of marriage in Ruſſia, he obſerved an old fellow lurking behind the church-door, and mumbling over a ſtring of words; and, at the ſame time, cutting a long rod, which he held under his arm, into pieces; which, it ſeems, is a common practice at the marriages of great perſons, and done with a deſign to elude and counterwork any other perſon that might poſſibly be inducing the ligature.

The ſecret of inducing a ligature is delivered by the ſame author, as he was taught it on the ſpot by one of their adepts: but it is too abſurd and obſcene to deſerve being tranſcribed here.

M. Marſhall mentions a ridiculous form of ligature, which he received from a bramin at Indoſtan; "If (ſays he) the little worm in the wood lukerara kara be cut into two, and the one part ſtirs and the other not, if the ſtirring part be bruiſed, and given with half a beetle to a man, and the other half to a woman, the charm will keep each from ever having to do with any other perſon." Phil. Tranſ. N° 268.

LIGATURE, in the Italian muſic, ſignifies a tying or binding together of notes. Hence ſyncopes are often called *ligatures*, becauſe they are made by the ligature of many notes. There is another ſort of ligatures for breves, when there are many of theſe on different lines, or on different ſpaces, to be ſung to one ſyllable,

LIGATURES, among printers, are types conſiſting of two letters or characters joined together; as *ct*, *&*, *ff*, *ſt*, *ſi*. The editions of Greek authors are extremely full of ligatures; the ligatures of Stephens are by much the moſt beautiful.—Some editions have been lately printed without any ligatures at all; and there was a deſign to explode them quite out of printing. Had this ſucceeded, the fineſt ancient editions would in time have grown uſeleſs: and the reading of old manuſcripts would have been rendered almoſt impracticable to the learned themſelves.

LIGHT, in the moſt common acceptation of the word, ſignifies that inviſible etherial matter which makes objects perceptible to our ſenſe of ſeeing. Figuratively, it is alſo uſed for whatever conveys inſtruction to our minds, and likewiſe for that inſtruction itſelf.

1
Opinions of the firſt philoſophers concerning light.

The nature of light hath been a ſubject of ſpeculation from the earlieſt ages of philoſophy. Some of thoſe firſt diſtinguiſhed by the appellation of philoſophers even doubted whether objects became viſible by means of any thing proceeding from them, or from the eye of the ſpectator. The fallacy of this notion muſt very ſoon have been apparent, becauſe, in that caſe, we ought to have ſeen as well in the night as in the day. The opinion was therefore qualified by Empedocles, and Plato; who mantained, that viſion was occaſioned by particles continually flying off from the ſurfaces of bodies, which met with others proceeding from

from the eye; but Pythagoras aſcribed it ſolely to the particles proceeding from the external objects and entering the pupil of the eye.

2
Of Des Cartes.

3
Of Sir Iſaac Newton.

Among the modern philoſophers there have been two celebrated opinions, *viz.* the Carteſian and Newtonian. According to the former, light is an inviſible fluid preſent at all times and in all places, but which requires to be ſet in motion by an ignited or otherwiſe properly qualified body in order to make the objects viſible to us.—The Newtonians maintain, that light is not a fluid *per ſe*, but conſiſts of a vaſt number of exceedingly ſmall particles ſhaken off in all directions from the luminous body with inconceivable velocity by a repulſive power; and which moſt probably never return again to the body from which they were emitted. Theſe particles are alſo ſaid to be emitted in right lines by the body from whence they proceed: and this rectilinear direction they preſerve until they are turned out of their original path by the attraction of ſome other body near which they paſs, and which is called *inflection*; by paſſing through a medium of different denſity, which is called *refraction*, or by being thrown obliquely or indirectly forward by ſome body which oppoſes their paſſage, and which is called *reflection*; or, laſtly, till they are totally ſtopped by the ſubſtance of any body into which they penetrate, and which is called their *extinction*. A ſucceſſion of theſe particles following one another in an exactly ſtraight line is called a *ray of light*; and this ray, in whatever manner it hath its direction changed, whether by refraction, reflection, or inflection, always preſerves its rectilinear courſe; neither is it poſſible by any art whatever to make it paſs on in the ſegment of a circle, ellipſis, or other curve.—From ſome obſervations on the eclipſe of Jupiter's ſatellites, and alſo on the aberration of the fixed ſtars, it appears that the particles of light move at the rate of little leſs than 200,000 miles in a ſecond of time. See ASTRONOMY-*Index*.

4
Objections to the Newtonian doctrine.

To this doctrine concerning the nature of light ſeveral objections have been made; the moſt conſiderable of which is, That in this caſe, the rays of light are continually paſſing in different directions from every viſible point, they muſt neceſſarily interfere with and deſtroy each other in ſuch a manner as entirely to confound all diſtinct perception of objects, if not to deſtroy the ſenſe of ſeeing altogether; not to mention the continual waſte of ſubſtance which a conſtant emiſſion of particles muſt occaſion in the luminous body, and which ſince the creation ought to have greatly diminiſhed the ſun and ſtars, as well as increaſed the bulk of the earth and planets by the vaſt quantity of particles of light abſorbed by them in ſuch a long period of time.

5
Anſwer by Mr Melville.

In anſwer to this objection, Mr Melville gives ſome ingenious illuſtrations concerning the extreme ſubtilty of light, or the ſmallneſs of the particles of which it conſiſts, and of which few perſons, even of thoſe who admit the hypotheſis, have any idea. He obſerves, that there is probably no phyſical point in the viſible horizon that does not ſend rays to every other point, unleſs where opaque bodies interpoſe. Light, in its paſſage from one ſyſtem to another, often paſſes thro' torrents of light iſſuing from other ſuns and ſyſtems, without ever interfering or being diverted in its courſe, either by it, or by the particles of that elaſtic medium which ſome phenomena give us reaſon to ſupppoſe are diffuſed through all the mundane ſpace. To account for this fact and others ſimilar to it, he concludes, that the particles of which light conſiſts, muſt be incomparably rare, even when they are moſt denſe; that is, that the ſemidiameters of the two neareſt particles, in the ſame or in different beams, ſoon after their emiſſion, are incomparably leſs than their diſtance from one another. This difficulty concerning the non-interference of the particles of light is not ſolved, as he obſerves, by ſuppoſing with Mr Boſcovich and others, that each particle is endued with an inſuperable impulſive force; becauſe, in that caſe, their ſpheres of impulſion would even be more liable to interfere, and they would on that account be more likely to diſturb one another.

6
Mr Canton.

The difficulty, according to Mr Canton, will nearly vaniſh, if a very ſmall portion of time be allowed between the emiſſion of every particle and the next that follows in the ſame direction. Suppoſe, for inſtance, that one lucid point of the ſun's ſurface emits 150 particles in a ſecond, which are more than ſufficient to give continual light to the eye without the leaſt appearance of intermiſſion; yet ſtill the particles of which it conſiſts, will on account of their great velocity be more than 1000 miles behind each other, and thereby leave room enough for others to paſs in all directions.

7
Experiments to determine the momentum of light.

8
by Mr Mairan.

In order to determine whether light really conſiſts of particles emitted from the luminous body, or only in the vibrations of a ſubtile fluid, it has been attempted to find out its momentum, or the force with which it moves. The firſt who ſet about this matter with any tolerable pretenſions to accuracy was M. Mairan. Others indeed, particularly Hatſocker and Homberg, had pretended, that in certain caſes this momentum was very perceptible; but M. Marian proved, that the effects mentioned by them were owing to currents of heated air produced by the burning-glaſſes uſed in their experiments, or to ſome other cauſes overlooked by theſe philoſophers. To decide the matter therefore, if poſſible, he began with trying the effects of rays collected by lenſes of four and ſix inches diameter, and thrown upon the needle of a compaſs; but the report was nothing more than ſome tremulous motion from whence he could draw no concluſion. After this, he and Mr du Fay conſtructed a mill of copper, and moved with an exceeding ſlight impulſe; but though they threw upon it the focus of a lens of ſeven or eight inches diameter, they were ſtill unable to draw any concluſions from the reſult.

M. Marian afterwards procured a horizontal wheel of iron three inches in diameter, having ſix radii, at the extremity of each of which was a ſmall wing fixed obliquely. The axis of the wheel which was alſo of iron was ſuſpended by a magnet. The wheel and the axis together did not weigh more than 30 grains; but though a motion was given to this wheel when the focus of the burning glaſs was thrown upon the extremities of the radii, yet it was ſo irregular, that he could not but conclude that it was occaſioned by the motion of the heated air. He then intended to have made his experiment *in vacuo*, but he concluded that it was unneceſſary. For, beſides the difficulty of making a vacuum, he was perſuaded that there was in our atmo-

ſphere

ſphere a thinner medium which freely penetrates even glaſs itſelf, the exiſtence of which he imagined that he had ſufficiently proved in his treatiſe on the aurora borealis. See *Aurora Borealis*, n° 3.

9
By Mr Michell.

Mr Michell ſome years ago endeavoured to aſcertain the momentum of light in a manner ſtill more accurate. The inſtrument he made uſe of for this purpoſe conſiſted of a very thin plate of copper, a little more than an inch ſquare, which was faſtened to one end of a ſlender harpſichord-wire about ten inches long. To the middle of this was fixed an agate cap, ſuch as is commonly uſed for ſmall mariner's-compaſſes, after the manner of which it was intended to turn ; and at the other end of the wire, was a middling ſized ſhot-corn, as a counterpoiſe to the copperplate. The inſtrument had alſo fixed to it in the middle, at right angles to the length of the wire, and in an horizontal direction, a ſmall bit of a very ſlender ſewing-needle, about one-third or perhaps half an inch long, which was made magnetical. In this ſtate the whole inſtrument might weigh about 10 grains. It was placed on a very ſharp-pointed needle, on which the agate cap turned extremely freely ; and to prevent its being diſturbed by any motion of the air, it was included in a box, the lid and front of which were of glaſs. This box was about 12 inches long, ſix or ſeven inches deep, and about as much in width ; the needle ſtanding upright in the middle. At the time of making the experiment, the box was placed in ſuch a manner that a line drawn from the ſun paſſed at right angles to the length of it ; and the inſtrument was brought to range in the ſame direction with the box, by means of the magnetical bit of needle abovementioned, and a magnet properly placed on the outſide, which would retain it, though with extremely little force, in any ſituation. The rays of the ſun were now thrown upon the copperplate abovementioned from a concave mirror of about two feet diameter, which, paſſing through the front-glaſs of the box, were collected into the focus of the mirror upon the copperplate. In conſequence of this the plate began to move, with a ſlow motion of about an inch in a ſecond of time, till it had moved through a ſpace of about two inches and a half, when it ſtruck againſt the back of the box. The mirror being removed, the inſtrument returned to its former ſituation by means of the little needle and magnet ; and the rays of the ſun being then again thrown upon it, it again began to move, and ſtruck againſt the back of the box as before : and this was repeated three or four times with the ſame ſucceſs.—The inſtrument was then placed the contrary way in the box to that in which it had been placed before, ſo that the end to which the copperplate was affixed, and which had lain, in the former experiment, towards the right hand, now lay towards the left ; and the rays of the ſun being again thrown upon it, it began to move with a ſlow motion, and ſtruck againſt the back of the box as before ; and this was repeated once or twice with the ſame ſucceſs. But by this time the copperplate began to be ſo much altered in its form, by the extreme heat which it underwent in each experiment, and which brought it nearly into a ſtate of fuſion, that it became very much bent. and the more ſo as it had been unwarily ſupported by the middle, half of it lying above and half below the wire to which it was faſtened. By this means it now varied ſo much from the vertical poſition, that it began to act in the ſame manner as the ſail of a windmill, being impelled by the ſtream of heated air which moved upwards, with a force ſufficient to drive it in oppoſition to the impulſe of the rays of light.

10
Dr Prieſtley's concluſions.

“ If we impute (ſays Dr Prieſtley) the motion produced in the above experiment to the impulſe of the rays of light, and ſuppoſe that the inſtrument weighed ten grains, and acquired a velocity of one inch in a ſecond, we ſhall find that the quantity of matter contained in the rays falling upon the inſtrument in that time amounted to no more than one twelve-hundredth-millionth part of a grain, the velocity of light exceeding the velocity of one inch in a ſecond in the proportion of about 12,000,000,000 to 1. Now the light in the above experiment was collected from a ſurface of about three ſquare feet, which reflecting only about half what falls upon it, the quantity of matter contained in the rays of the ſun incident upon a ſquare foot and an half of ſurface in one ſecond of time, ought to be no more than the twelve-hundred-millionth part of a grain, or upon one ſquare foot only, the eighteen-hundred-millionth part of a grain. But the denſity of the rays of light at the ſurface of the ſun is greater than at the earth in the proportion of 45,000 to 1 : there ought, therefore, to iſſue from one ſquare foot of the ſun's ſurface in one ſecond of time, in order to ſupply the waſte by light, one forty-thouſandth part of a grain of matter ; that is, a little more than two grains in a day, or about 4,752,000 grains, or 670 pounds avoirdupoiſe nearly, in 6000 years ; a quantity which would have ſhortened the ſun's ſemidiameter no more than about ten feet, if it was formed of the denſity of water only.”

11
Objections againſt the Carteſian opinion by Sir Iſaac Newton.

The Newtonians, beſides the anſwer juſt now given to the moſt formidable objections of their opponents, have endeavoured to prove the impoſſibility of light being a vibration in any fluid. Sir Iſaac, in his Principia, demonſtrates, that no rectilinear motion can be propagated among the particles of any fluid unleſs theſe particles lie in right lines ; and he hath alſo ſhown, that all motion propagated through a fluid diverges from a rectilinear progreſs into the unmoved ſpaces. Hence he concludes, “ a preſſure on a fluid medium (i. e. a motion propagated by ſuch a medium beyond any obſtacle, which impedes any part of its motion), cannot be propagated in right lines, but will be always inflecting and diffuſing itſelf every way, to the quieſcent medium beyond that obſtacle. The power of gravity tends downwards ; but the preſſure of water riſing from it tends every way with an equable force, and is propagated with equal eaſe, and equal ſtrength, in curves, as in ſtraight lines. Waves, on the ſurface of the water, gliding by the extremes of any very large obſtacle, inflect and dilate themſelves, ſtill diffuſing gradually, into the quieſcent water beyond that obſtacle. The waves, pulſes, or vibrations of the air, wherein ſound conſiſts, are manifeſtly inflected, though not ſo conſiderably as the waves of water ; and ſounds are propagated with equal eaſe, through crooked tubes and through ſtraight lines ; but light was never known to move in any curve, nor to inflect itſelf *ad umbram*.”

12
By Mr Rowning.

To this Mr Rowning adds another proof. “ The Carteſian notion of light (ſays he), was not that it is propagated from luminous bodies by the emiſſion of ſmall particles, but that it was communicated to the organ of ſight by their preſſure upon the *materia ſubtilis*, with which they ſuppoſed the univerſe to be full. But, according to this hypotheſis, it could never be dark; becauſe, when a fluid ſuſtains any preſſure, if that fluid fills all the ſpace it takes up, abſolutely, without leaving any pores, which is the caſe of the ſuppoſed *materia ſubtilis*, then that preſſure muſt neceſſarily be communicated *equally* and *inſtantaneouſly* to every part. And therefore, whether the ſun were above or below the horizon, the preſſure communicated, and conſequently the light, would be the ſame. And farther, as the preſſure would be inſtantaneous, ſo would the light, which is contrary to what is collected from the eclipſes of Jupiter's ſatellites."

It is obvious, however, that whatever ſide we take concerning the nature of light, many, indeed almoſt all the circumſtances concerning it, are incomprehenſible, and beyond the reach of human underſtanding.

13
Unaccountable properties of light.

Moſt of the diſcous flowers, by ſome power unknown to us, follow the ſun in his courſe. They attend him to his evening retreat, and meet his riſing luſtre in the morning with the ſame unerring law. If a plant alſo is ſhut up in a dark room, and a ſmall hole is afterwards opened by which the light of the ſun may enter, the plant will turn towards that hole, and even alter its own ſhape in order to get near it; ſo that though it was ſtraight before, it will in time become crooked, that it may get near the light. It is not the *heat*, but the *light* of the ſun, which it thus covets; for, though a fire kept in the room, capable of giving a much ſtronger heat than the ſun, the plant will turn away from the fire in order to enjoy the ſun's light. The green colour of plants alſo depends on the ſun's light being allowed to ſhine upom them; for without this they are always white.—From this laſt circumſtance, and likewiſe the property which the ſolar light has of blackening precipitates of ſilver from the nitrous acid*, it has been thought that light either contains the *phlogiſton* in very conſiderable quantity, or is itſelf a modification of that unknown ſubſtance. But that this cannot be the caſe, we have now a proof little ſhort of demonſtration, from the laſt experiments of Dr Prieſtley concerning the production of pure dephlogiſticated air from pump-water, by means of the ſolar light †. If light either were the phlogiſton itſelf, or contained it in very conſiderable quantity, it is impoſſible the air produced by its means could be pure and dephlogiſticated.—For the properties of light acting as the medium of our perceptions by the ſenſe of ſight, ſee the article Optics.

14
Is not a modification of the phlogiſton.

15
Dr Fordyce's experiments on the light produced by inflammation.

In the Philoſophical Tranſactions for 1776, Dr Fordyce gives an account of ſome experiments upon the light produced by Inflammation. They were made to determine, whether there was any light produced by the inflammation itſelf, independent of ignition. Subſtances, he obſerves, begin to be luminous in the dark when heated to between 6 and 700 degrees of Fahrenheit's thermometer. If the ſubſtances be colourleſs, they firſt emit a red light; then a red mixed with yellow; and laſtly, with a great degree of heat, a pure white. This whiteneſs, however, ſeems to depend greatly upon the denſity of the body; for the vapour at the end of the flame urged by a blow-pipe is not viſibly luminous, though its heat be ſufficiently great to give a white heat to glaſs. The colour of the ignited matter, according to our author, has an effect upon the colour of the light emitted. Thus, during the calcination of zinc, the calx of which is white, a light is produced ſcarce inferior in beauty to that of the ſun himſelf. A beautiful green is communicated by the green calx of copper to the flame of a fire into which it is thrown; and the yellow empyreumatic oil into which tallow or any common oil is converted in burning, communicates a part of its own colour to the flame, which very much alters the appearance of bodies ſeen by candle-light from what it is by day-light. It does not, however, appear that this always holds good; for the flame of burning iron is intenſely white; and yet neither the metal itſelf nor any of its calces are of that colour.

16
Colour of the ignited matter ſuppoſed to have an influence in the colour of the flame.

17
Light produced in ſome caſes with very little heat.

Light produced by the decompoſition of bodies by inflammation without ignition is always blue, and produces very little heat. Thus phoſphorus of urine is decompoſed by mere expoſure to the air, and gives but very little heat, though a conſiderable light is emitted. The following proof is adduced by our author that this emiſſion of light is a true inflammation. "Take a receiver of white glaſs, capable of holding ſix or eight gallons; put into it a drachm of phoſphorus finely powdered, and half an ounce of water; cork the mouth of the receiver, and tie it over with a bladder, ſo as to exclude the external air; incline the receiver to all ſides gently, and afterwards ſet it to reſt; the powder will adhere to the ſides, and the water will drain from it. As ſoon as the water is ſufficiently drained off, the particles of the phoſphorus will become luminous, and emit a thick ſmoke: this will continue for ſome days; but at laſt no more light or vapour will appear. Open the receiver, and you will find that the air will have contracted, as it does from the inflammation of a candle in Van Helmont's experiment; that is, about a twentieth part. It is become unfit for inflammation; for if a lighted candle be immerſed in it, it will be extinguiſhed as well as the phoſphorus, and an animal will be ſuffocated by it. The air then has ſuffered the ſame change as that which has ſerved for the inflammation of other bodies; and the phoſphorus is partly decompoſed, the water in the receiver being impregnated with its acid, and the air ſaturated with its phlogiſton. Blow freſh air into the receiver, and the light and ſmoke will immediately re-appear. In like manner it is known that ſulphur will burn and give light without heat ſufficient for ignition. Take a piece of iron heated nearly red hot, and throw a little gunpowder upon it. If the heat be of a proper degree, the ſulphur will burn off with a blue flame, without heat ſufficient for ignition; for if ſuch heat had been produced, the gun-powder would certainly have taken fire. It is the inflammation and decompoſition of the ſulphur, and not its evaporation, which produces the light; for if we ſublime ſulphur in veſſels of the moſt tranſparent glaſs, no light will be viſible except at the very beginning, when a ſmall portion of it burns till the air in the veſſel be ſaturated, and rendered unfit for inflammation."

18
Light from inflammation ſuppoſed to be always blue.

Our author is of opinion, that the light produced by inflammation is of a blue colour, from whatever body it is derived. This he endeavours to prove from an obſervation on the flame of a candle, the lower part of which, where the inflammation is, always appears of

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* See *Chemiſtry*, nº 756.

† See *Aerology*, nº 36, *et ſeq.*

a blue colour. "Or (ſays he) take a candle which has burned for ſome time; extinguiſh it by applying tallow to the wick, and let it ſtand to cool; afterwards ſet it on fire by the flame of another candle; at firſt no more vapour will ariſe than can be acted upon by the air at once; inflammation, therefore, will go on in the whole ſmall flame, and it will be blue.

19 Obſervations on the burning of a candle.

When a candle burns, the following proceſs takes place. The tallow boils in the wick; and is converted into empyreumatic oil, riſing from it in the form of vapour. As it riſes from every part of the wick, the volume is increaſed till it comes to the top, and gives to the lower part of the flame the form of the fruſtum of an inverted cone. The air is applied to the outer ſurface of the column of vapour; and there decompoſing the empyreumatic oil, produces heat and blue light: the ſtratum of vapour, within the outer burning ſurface, is heated white-hot; the heat diminiſhes towards the centre, which, if the flame be large, is ſcarcely red-hot; as the column riſes, decompoſition taking place conſtantly on its ſurface, it neceſſarily diminiſhes, and the upper part of the flame is conical. That the tallow boils in the wick, can be ſeen: that it is converted into empyreumatic oil, is proved by drawing the vapour, riſing in the middle of the flame, where it does not burn, into a glaſs-tube: the empyreumatic oil condenſes; this alſo ſhows that the flame does not burn in the middle. That the heat is produced on the outer ſurface, appears, if we take a ſmall rod of glaſs, and put the end of it in the blue flame on the ſurface; it will be heated white hot, and melt. Immerſe the rod into the flame, ſo that the point ſhall be in the centre: it will melt and bend where it is in the blue flame on the ſurface; whereas, if the flame be large, the point which is in the centre will hardly be heated red-hot. That the empyreumatic oil is decompoſed, is proved by burning a candle with a very ſmall wick in diſtilling veſſels; no condenſation of empyreumatic oil takes place."

20 Mr Morgan's obſervations upon light.

In the 75th volume of the Tranſactions, Mr Morgan treats the ſubject of light at ſome length. As a foundation for his reaſoning he aſſumes the following data. 1. That light is a body, and, like all others, ſubject to the laws of attraction. 2. That light is an heterogeneous body; and that the ſame attractive power operates with different degrees of force on its different parts. 3. That the light which eſcapes from combuſtibles when decompoſed by heat, or by any other means, was, previous to its eſcape, a component part of theſe ſubſtances. Hence he concludes, that when the attractive force by which the ſeveral rays of light are attached to a body is weakened, ſome of thoſe rays will eſcape ſooner than others; it being evident that thoſe which are detained by the ſmalleſt power will ſooneſt go off when the general attractive force is weakened. This he illuſtrates by the example of a mixture of ſpirit of wine, water, and other more fixed ſubſtances. The application of a gentle heat will carry off the ſpirit of wine only; a heat not much greater will evaporate the ſpirits and water mixed together; and a ſtill greater degree will carry off a mixture of all the particles together. "In like manner (ſays he), when the ſurface of a combuſtible is in a ſtate of decompoſition, thoſe parts of it which are the leaſt fixed, or which are united with the leaſt force, will be ſeparated firſt. Amongſt theſe, the indigo rays of light will make the earlieſt appearance. By increaſing the heat, we ſhall mix the violet with the indigo: by increaſing it ſtill more, we ſhall add the blue and the green to the mixture, till at length we reach that intenſity of heat which will cauſe all the rays to eſcape at the ſame inſtant, and make the flame of a combuſtible perfectly white.

21 Remarks on the flame of a candle.

By examining the flame of a common candle, we may obſerve, that its loweſt extremities, or the part in which the black colour of the wick terminates, diſcharges the leaſt heat; and that, as the vertex of the flame is approached, a ſucceſſive order of parts is paſſed through, in which the loweſt is continually adding to the heat of that which is juſt above it, till we come to the top of the flame, near which all the heat is collected into a focus. At the loweſt extremity, however, where the heat is inconſiderable, a blue colour may always be obſerved; and from this appearance, amongſt others, I think it may be concluded, that the blue rays are ſome of thoſe which eſcape from combuſtibles in an early period of their decompoſition; and that if the decompoſition could be examined in a period ſtill more early, the colour of the flame would be violet. By an *à priori* deduction of this kind, I was led to obſerve, that to the external boundary of the flame of a common candle is annexed a filament of light; which if proper care be taken to prevent the eſcape of too much ſmoke, will appear moſt beautifully coloured with the violet and indigo rays. If ſulphur or ether be burned, or any other combuſtible whoſe vapour is kindled in a ſmall degree of heat, a blue flame will appear; which, if examined by the priſm, will be found to conſiſt of the violet, the indigo, the blue, and ſometimes a ſmall quantity of the green rays. The beſt mode, however, of ſhowing the eſcape of ſome rays by that degree of heat which will not ſeparate others till increaſed, is the following.

22 Curious experiment with a piece of brown paper.

Give a piece of brown paper a ſpherical form, by preſſing it upon any hard globular ſubſtance. Gradually bring the paper thus formed to that diſtance from the candle at which it will begin to take fire. In this caſe a beautiful blue flame may be ſeen hanging, as it were, by the paper till a hole is made in it; when the flame, owing to the increaſed action of the air upon all parts of it, becomes white, though the edges ſtill continue of a blue or violet colour. As a confirmation of this, it may be obſerved, that the very flame, which when expoſed to a certain degree of heat emits only the moſt refrangible rays, will, if expoſed to one conſiderably greater, emit alſo thoſe which are leſs ſo. The flames of ſulphur and ſpirit of wine, if ſuddenly expoſed to the heat of a reverberatory, will change their blue colour for one that is perfectly white."

23 Experiments on light by Melville's method.

To obtain a more perfect knowledge of this matter, our author examined the light proceeding from combuſtible bodies by Mr Melville's method. Having darkened the room, he interpoſed betwixt the eye and combuſtible a ſheet of paſteboard, in which was a very ſmall hole for tranſmitting the light. Viewing the light which paſſed through this hole with a priſm, he obſerved, that the blue and violet rays were in greater abundance than any of the reſt, though all the different kinds paſſed through it when ſpirit of wine only was made uſe of. When the combuſtion of the ſpirit of wine was checked by throwing in ſal ammoniac, the red rays diſappeared, but made their appearance again as ſoon as the ſalt became heated to ſuch a degree as to increaſe rather than diminiſh the combuſtion of the ſpirits. On examining the different parts of the flame ſeparately, it was always found that the colours varied according to the degree of heat. At the baſe of the flame, or where the heat was leaſt, the indigo, violet, and blue always appeared in greateſt quantity; but as the vertex was approached, the other rays appeared, and at the very top they were all viſible through a priſm.

23 Concluſions from theſe experiments.

From theſe facts Mr Morgan concludes, 1. That light, as an heterogeneous body, is gradually decompoſed during combuſtion; that the indigo rays eſcape with the leaſt heat, and the red with the greateſt; and from this again he explains the reaſon why flames aſſume different colours. "If a piece of paper (ſays he), impregnated with a ſolution of copper in nitrous acid, be ſet on fire, the bottom and ſides of the flame are always tinged green. Now this flame is evidently in that weak ſtate of decompoſition in which the moſt refrangible rays eſcape in the greateſt abundance; but of theſe the green rays eſcape moſt plentifully through the unignited vapour and that portion of the atmoſphere which is interpoſed betwixt the eye and the flame. This peculiarity may be obſerved in greateſt perfection in braſs founderies. Here the heat, though very ſtrong, is ſcarcely ſufficient to decompoſe the metallic vapour which eſcapes from the melted braſs; whence the flame has a very ſingular appearance, the edges being green, and the body of ſuch an appearance, as to give ſubſtances viewed by it a pallid and ghaſtly appearance, owing to the want of a ſufficient quantity of red rays to make a perfect white."

25 Red appearance of bodies in their laſt ſtate of ignition explained.

2. Mr Morgan explains the red appearance of bodies in their laſt ſtate of ignition, from the previous eſcape of the more refrangible rays, ſo that only the red ones remain. "Again, (ſays he), we may conſider the external ſurface of the combuſtible body as annexed to an inner ſurface, which may be partly, but not ſo perfectly decompoſed as itſelf: for the violence of the heat will be found to leſſen in its effects the nearer it approaches to the centre of the ſubſtance which is expoſed to it. Hence we are to conſider the parts which are juſt covered by the external ſurface as having loſt leſs of their component light than the external ſurface itſelf; or the former may retain the green rays when the latter has loſt both indigo, violet, blue, and green.

3. "Thoſe parts which are nearer the centre of the body than any of the preceding, muſt, as they are farther from the greateſt violence of the heat, have loſt proportionably fewer of their rays; or while the external parts may have loſt all but the red, theſe may have loſt only the indigo and violet.

4. "The moſt central parts may be unaffected by the heat; and whenever the fire does reach theſe parts, they will immediately diſcharge their indigo rays, and be decompoſed in the gradual manner already mentioned. A piece of rotten wood, while burning, will exemplify and confirm the preceding illuſtration. When influenced by the external air only, if examined through a priſm, no rays will be found to eſcape but the orange and the red. By blowing upon the burning wood with a pair of bellows, the combuſtion being increaſed, will affect thoſe internal parts of the body which were not acted upon before. Theſe parts therefore will begin to loſe their light, and a priſm will ſhow the green, blue, violet, and indigo, all appearing in ſucceſſion. Appearances ſimilar to the preceding may be obſerved in a common kitchen fire. When it is fainteſt, its colour is moſt red, the other rays having been emitted, and the combuſtion at a ſtand; but by blowing upon it in this ſtate, its brightneſs will be encreaſed, and more and more of the rays which are yielded by the internal parts of the body will come to the eye, till at length, by continuing to blow, the combuſtion will be made ſo complete as to yield all the rays, or to make it appear perfectly white."

26 Sir Iſaac Newton's definition of *flame* criticiſed by Mr Morgan.

Our author concludes the ſubject with a criticiſm upon Sir Iſaac Newton's definition of flame, viz. that it is a vapour heated red hot. In his opinion, flame is an inſtance of combuſtion whoſe colour will be determined by the degree of decompoſition which takes place. When very imperfect, only the moſt refrangible rays will appear. If it be very perfect, all the rays will appear, and its flame will be brilliant in proportion. But there are flames which conſiſt of burning particles, the rays of which have partly eſcaped before they aſcended in form of vapour. "Such (ſays he) would be the flame of a red coal, if expoſed to ſuch a heat as would gradually convert it into vapour. When the fire is very low under the furnace of an iron foundary, at the upper orifice of the chimney a red flame of this kind may be ſeen, which is different from the flame that appears immediately after freſh coals have been thrown upon the fire; for in conſequence of adding ſuch a ſupply to the burning fuel, a vaſt column of ſmoke aſcends, and forms a medium ſo thick as to abſorb moſt of the rays excepting the red."

27 Mr Morgan's theory not well founded.

Thus we have a moſt elaborate theory for the ſolving of phenomena which ſeem not eaſily to admit of any ſolution. It is obvious, however, that the data upon which he builds his ſyſtem are altogether unfounded and hypothetical. That light is ſubject to the laws of attraction, cannot be proved unleſs we could examine it independent of any other ſubſtance whatever; that is to ſay, in a perfect vacuum; and even in the moſt perfect vacuum that can be formed, we are far from being certain that no other matter is preſent. Light is inflected and turned out of its courſe in many different ways when acting in the common atmoſphere, but we have no reaſon to ſuppoſe that it would be the ſame in a perfect vacuum; at leaſt we have not a right to lay it down as a principle to argue from, unleſs it were verified by experience. Even the heterogeneous nature of light ſeems far from being abſolutely eſtabliſhed. The refraction into different colours by the priſm ſeems inſufficient to do ſo; for though, by a quick revolution of theſe colours when painted upon any ſubſtance, we may produce a kind of white colour, it is by no means perfect, but looks as if ſome black had got amongſt it. The opinion of thoſe who maintain that the priſmatic colours are no other than different mixtures of light and ſhade, ſeems therefore equally probable with the other. His third poſition, that the light emitted by combuſtible bodies formed part of their ſubſtance before combuſtion, ſeems ſtill worſe founded; for inſtead of being fixed in ſolid ſubſtances, all the light and proceeding from combuſtion ſeem entirely to come from the air. By means of heat originally applied, the ſubſtance, or part of it, is rarefied into vapour; and this vapour, we have every reaſon to ſuppoſe, conſiſts of elementary fire united with the ſolid ſubſtance. It is this fire, heat, or light, which is afterwards thrown out from the vapour in combuſtion; and new ſupplies of it perpetually come from the atmoſphere, as is abundantly ſhown under the articles COMBUSTION, FIRE, FLAME, and many others throughout this work. We cannot therefore think it either inconſiſtent, or very improbable, that in the beginning of combuſtion, when the *white* light is clouded with a great quantity of vapour, it ſhould appear of a blue or violet colour; and that in proportion as this vapour is diſſipated, it ſhould appear green, yellow, red, or perfectly white: for it is obſervable, that in dephlogiſticated air, even thoſe flames which in the common atmoſphere always appear blue, ſuch as ſulphur and ſpirit of wine, are then changed to a dazzling white. The pure light of the ſun alſo ſeen through ſmoke, or even through a great quantity of aqueous vapour, appears red; and there is not the leaſt doubt, that if we were to view the ſun while he thus appears red through any blue medium, he would appear purple; and in like manner, were we to view a blue flame through a yellow medium, it would appear of a green colour.

28
His obſervations on electric light.

In the ſame paper Mr Morgan has ſome curious obſervations upon the electric light. There is neither fluid or ſolid, he ſays, through which the electric fluid in its paſſage will not appear luminous, if we do not make the quantity, through which it has to paſs, too great. In his experiments on fluids, he puts them into a tube about three quarters of an inch diameter and four inches long. The orifices are then ſtopped up with two corks, through which two pointed wires are thruſt, ſo that the points may approach within one eighth part of an inch of each other; and in this caſe the electric matter which paſſes through the fluid is always luminous, provided a ſufficient force be uſed. The experiment, however, is dangerous, unleſs great care be taken; and the tube, unleſs it be very ſtrong, will be broken by a very ſlight diſcharge. With acids the experiment ſucceeds more difficultly; they muſt be put into capillary tubes, and the wires placed very near to each other. A ſtripe of gold leaf one eighth of an inch diameter, and a yard long, becomes quite luminous by diſcharging a battery over it; and our author cannot aſcertain the length to which it might be made luminous. The experiment will alſo ſucceed with Dutch metal or ſilver leaf. If the gold or ſilver leaf be put upon a glaſs, and that laid in water, the whole will appear moſt beautifully luminous on diſcharging a battery through it.

The better a conductor that any ſubſtance is, the greater is the difficulty of making the electric ſpark viſible in it. Hence it requires a much greater power of electricity to make a ſpark viſible in boiling than in cold water; the former being a much better conductor than the latter. In like manner, the mineral acids are much better conductors than common water; and, of conſequence, the ſpark is made to appear in them with much more difficulty than in water. This appears from what has been already mentioned; and our author likewiſe obſerves, that if a few drops of acid be poured into the tube containing the water employed for this purpoſe, it will ſcarcely be poſſible to make the ſpark luminous in it by any force.

The rarity of any body greatly increaſes the eaſe with which the electric ſpark is made viſible in it; as appears from diſcharging a vial through rarefied air, the vapour of ether, ſpirit of wine, or water.

In the proſecution of his experiments upon this ſubject, our author cemented a ball of iron into the orifice of a tube 48 inches long, and two thirds of an inch diameter, ſo that it could bear the weight of the quickſilver with which the tube was filled all to a ſmall ſpace at the open end, which contained a few drops of water. Having inverted the tube, and plunged the open end of it into a baſon of mercury, that in the tube ſtood nearly half an inch lower than in a barometer with which it was compared at the ſame time, owing to the vapour which was formed by the water; but the ſpark paſſed as brilliant through the rarefied water as it does through rarefied air. If ſpirit of wine be employed inſtead of water in this experiment, the ſpark will not be ſo luminous. In the vapour of ether a great force is requiſite to make the ſpark luminous, but good ether will preſs the mercury down as far as 16 or 17 inches. By rarefying the vapour, however, the ſpark will paſs through it with more eaſe.

On examining the mineral acids *in vacuo*, Mr Morgan could not find that any vapour eſcaped from them. To give them the requiſite degree of tenuity, therefore, he traced a line upon glaſs about an eighth part of an inch broad, with a camel's hair pencil dipped in the acids: the line extended ſometimes to the length of 27 inches; in which caſe, the electric ſpark would paſs over the whole with great brilliancy. If by widening the line, however, or putting on a drop of acid in any particular part, the quantity was increaſed, the ſpark never appeared in that part.

29
Of the brightneſs of electric light.

The brightneſs of electric light is always in proportion to its condenſation. Thus, if a ſpark taken from a powerful electrical machine divides itſelf into bruſhes, or throws out ſparks from the ſides, by which the light is diffuſed over a larger ſurface, it thus becomes leſs brilliant; and in all caſes in which any diffuſion of light, whether electric or not, takes place, the caſe will be the ſame.

30
Sometimes the more refrangible rays only eſcape from the electric fluid.

In ſome caſes, Mr Morgan is of opinion, that, even with the electric fluid, only the more refrangible rays of light make their eſcape. Thus, the electrical bruſh is always of a purpliſh or bluiſh colour; and if you convey a ſpark through a Torricellian vacuum not very perfectly made, it will be of an indigo colour. This, however, does not ſeem to ariſe from any other cauſe than the mere weakneſs of the light, which, in paſſing through the vapours of the atmoſphere, or perhaps through the humours of the eye itſelf, affects our organs of ſight in that manner.

31
Influence of media upon electric light.

Our author next proceeds to examine the influence of media upon electric light; which, he ſays, is ſimilar to their influence upon ſolar light, and ſerves to explain ſeveral phenomena.

“Let a pointed wire (ſays he), having a metallic ball fixed to one of its extremities, be forced obliquely into a piece of wood, ſo as to make a ſmall angle with its ſurface; and to make the point lie about one eighth of an inch below it. Let another pointed wire, which communicates with the ground, be forced in the ſame manner into the ſame wood, ſo that its point may in like manner be about one eighth of an inch below the ſurface, and about two inches diſtant from the point

32 Curious experiment of ſending the electric ſpark thro' wood.

of the firſt wire. Let the wood be inſulated, and a ſtrong ſpark, which ſtrikes on the metallic ball, will force its way through the interval of wood which lies between the points, and appear as red as blood. To prove that this appearance depends on the wood's abſorption of all the rays but the red, I would obſerve, that the greater the depth of the points is below the ſurface, the leſs mixed are the rays. When they are deepeſt below the ſurface, only the red comes to the eye through a priſm; when raiſed a little nearer the ſurface, the red and orange appeared; when nearer ſtill, the yellow; and ſo on, till, by making the ſpark paſs through the wood very near its ſurface, all the rays were at length able to reach the eye. If the points be only one eighth of an inch below the ſurface of ſoft deal wood, the red, the orange, and the yellow rays will appear as the ſpark paſſes through it. But when the points are at an equal depth in a piece of harder wood, box for inſtance, the yellow, and perhaps the orange will diſappear. As a farther proof of this abſorption of the rays, it may be obſerved, when the ſpark ſtrikes very bright upon one ſide of the piece of deal, it will appear quite red on the other. In like manner, a red appearance may be given to a ſpark which ſtrikes bright over the inſide of a tube, merely by ſpreading ſome pitch very thinly over the outſide of the ſame tube."

33 Different appearance of the electric ſpark at different diſtances.

Mr Morgan now proceeds to mention ſome experiments which ſeem to militate againſt the doctrine he has been endeavouring to eſtabliſh, rather than to ſupport it; viz. 1. If into a Torricellian vacuum of any length a few drops of ether are conveyed, and both ends of the vacuum ſtopped up with metallic conductors, ſo that a ſpark may paſs through it, the ſpark in its paſſage will make the following appearances. When the eye is placed cloſe to the tube, the ſpark will appear perfectly white; if the eye is removed to the diſtance of two yards, it will appear green; but at the diſtance of ſix or ſeven yards, it will appear reddiſh. "Theſe changes evidently depend (ſays our author) on the quantity of medium through which the light paſſes; and the red light more particularly, which we ſee at the greateſt diſtance from the tube, is accounted for on the ſame principle as the red light of the beclouded ſun, or a lighted candle."

2. Dr Prieſtley long ago obſerved the red appearance of the electric ſpark, when paſſing through inflammable air. But this appearance is very much diverſified according to the quantity of medium through which the ſpark is beheld. At a very conſiderable diſtance the red comes unmixed to the eye; but if the eye be placed cloſe to the tube, the ſpark appears white and brilliant. By increaſing, however, the quantity of fluid conveyed through any portion of inflammable air, or by condenſing that air, the ſpark may be made perfectly white. It may further be obſerved, that all weak exploſions and ſparks, when viewed at a diſtance, make a reddiſh appearance. The reaſon of theſe appearances ſeems to be, that the weaker the ſpark or exploſion is, the more it is diſpoſed to aſſume a red colour when viewed at a diſtance. This ſeems to confirm what has already been mentioned as a probable hypotheſis, that the different colours of light are entirely owing to the medium through which they are viewed.

33 Obſervations on phoſphoric light.

On phoſphoric light Mr Morgan makes ſome curious obſervations; but ſtill argues on the ſame principles we have already mentioned. "Some ſhells (ſays he), prepared according to Mr Wilſon's directions*, after being expoſed to the ſun, or to the flaſh of a battery, emit a purple, others a green, and others a reddiſh light. If, with Mr Wilſon, we ſuppoſe that theſe ſhells are in a ſtate of ſlow combuſtion, may we not conclude that ſome are juſt beginning to burn, and therefore emmitting the moſt refrangible rays; while others are in a more advanced ſtate of combuſtion, and therefore emitting the leaſt refrangible? If this concluſion be right, the ſhells which are emitting the purple or the green, muſt ſtill retain the yellow, the orange, and the red, which will alſo make their appearance as ſoon as the combuſtion is ſufficiently increaſed. In confirmation of this, Mr Morgan adduces the following experiment, viz. that if a ſhell, while emitting its green rays, be placed upon a warm ſhovel, the colour will ſoon be changed into a yellow mixed with red.—To the theory of ſlow combuſtion Mr Morgan makes the following objections.

1. If phoſphoric ſhells owe their light to this cauſe, we muſt conſider the word combuſtion, when applied to them, as implying all thoſe circumſtances which uſually attend a body when on fire. On this ſuppoſition there ought to be an increaſe of the heat as well as of the decompoſition of the combuſtible. But neither of theſe are found to take place in fact; for a phoſphoric body never fails to loſe its light entirely in a certain degree of heat, without loſing the power of becoming phoſphoric again when it has been ſufficiently cooled. While very hot, the charge of the ſtrongeſt battery conveyed over it has no effect.

2. When bodies are waſted by combuſtion, they can never be made to reaſſume the appearances which they previouſly diſplayed. "No power (ſays our author) can give to aſhes the phenomena of a burning coal. But phoſphoric bodies are very different in this reſpect; for a phoſphoric ſhell may be made to loſe all its light by expoſure to heat, and again may be made as luminous as ever by expoſure to the ſun."

3. It is remarkable that ſome bodies which are moſt beautifully phoſphoric, are at the ſame time the moſt obſtinate in reſiſting fire. "Let us now ſee (ſays Mr Morgan), the conſequence of admitting the common hypotheſis, that the detention of thoſe rays which fall upon phoſphori is owing to ſome force which prevents their immediate reflection, but is not adequate to their entire abſorption. This force, whatever it be, cannot well be ſuppoſed to operate with equal power on all theſe rays. If this be not the caſe, we cannot well avoid concluding, that phoſphoric ſhells will aſſume different colours, owing to the earlier and later eſcape of the different rays of light. This concluſion is juſtified by an experiment already mentioned; viz. that when the force is ſuch as to admit the eſcape of the purple, blue, and green, we have only to leſſen that force, by warming the body, and the yellow, the orange, and red eſcape. Beccaria has proved, that there is ſcarcely any body which is not phoſphoric, or may not become ſo by heat. But as the phoſphoric force is moſt powerful when the purple rays only eſcape, ſo we are to conclude, that it is weakeſt when it is able to retain the red rays only. This is agreeable to ſeveral facts.

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* See *Phoſphorus*.

Chalk, oyſter-ſhells, together with thoſe phoſphoric bodies whoſe goodneſs has been very much impaired by long keeping, when finely powdered, and placed within the circuit of an electrical battery, will exhibit, by their ſcattered particles, a ſhower of light; but theſe particles will appear reddiſh, or their phoſphoric power will be ſufficient only to detain the yellow, orange, and red rays. When ſpirit of wine is in a ſimilar manner brought within the circuit of a battery, a ſimilar effect may be diſcovered: its particles diverge in ſeveral directions, diſplaying a moſt beautiful golden appearance. The metallic calces are rendered phoſphoric with the greateſt difficulty; but even theſe may be ſcattered into a ſhower of red luminous particles by the electric ſtroke."

In a poſtſcript to this paper, by Dr Price, it is obſerved, that by *phoſphoric force,* Mr Morgan ſeems to mean, not the force with which a phoſphoric body *emits,* but that with which it *abſorbs* and *retains,* the light. This laſt force is proportioned to the degree of attraction between the phoſphoric body and light; and therefore muſt, according to Mr Morgan's theory, be weakeſt when it ſo freely emits the light it has imbibed as not to retain thoſe rays which adhere to it moſt ſtrongly. According to Mr Morgan's theory, theſe are the rays which are the leaſt refrangible. "It is, however, (ſays Dr Price), an objection to it, that the leſs refrangibility of rays ſeems to imply a leſs force of attraction between them and the ſubſtances which refract them; but it ſhould be conſidered, that, poſſibly, the force of coheſion, which unites the rays of light to bodies, may be a different power from that which refracts them."

Light independent of Heat. In general, a very conſiderable degree of heat is requiſite to the emiſſion of light from any body; but there are ſeveral exceptions to this, eſpecially in light proceeding from putreſcent ſubſtances and phoſphorus, together with that of luminous animals, and other ſimilar appearances. Light proceeding from putreſcent animal and vegetable ſubſtances, as well as from glow-worms, is mentioned by Ariſtotle. Thomas Bartholin mentions four kinds of luminous inſects, two with wings, and two without; but in hot climates travellers ſay they are found in much greater numbers, and of different ſpecies. Columna, an induſtrious naturaliſt, obſerves, that their light is not extinguiſhed immediately upon the death of the animal.

De luce animal, p. 183. 206.

34
Light from putrid fleſh.

De Viſione, p. 45.

The firſt diſtinct account that we meet with of light proceeding from putreſcent animal fleſh is that which is given by Fabricius ab Aquapendente; who ſays, that when three Roman youths, reſiding at Padua, had bought a lamb, and had eaten part of it on Eaſter day 1592, ſeveral pieces of the remainder, which they kept till the day following, ſhone like ſo many candles when they were caſually viewed in the dark. Part of this luminous fleſh was immediately ſent to Aquapendente, who was profeſſor of anatomy in that city. He obſerved that both the lean and the fat of this meat ſhone with a whitiſh kind of light; and alſo took notice that ſome pieces of kid's fleſh, which had happened to have lain in contact with it, was luminous, as well as the fingers and other parts of the bodies of thoſe perſons who touched it. Thoſe parts, he obſerved, ſhone the moſt which were ſoft to the touch, and ſeemed to be tranſparent in candle light; but where the fleſh was thick and ſolid, or where a bone was near the outſide, it did not ſhine.

After this appearance, we find no account of any other ſimilar to it, before that which was obſerved by Bartholin, and of which he gives a very pompous deſcription in his ingenious treatiſe already quoted. This happened at Montpelier in 1641, when a poor old woman had bought a piece of fleſh in the market, intending to make uſe of it the day following. But happening not to be able to ſleep well that night, and her bed and pantry being in the ſame room, ſhe obſerved ſo much light come from the fleſh, as to illuminate all the place where it hung. A part of this luminous fleſh was carried as a curioſity to Henry Bourbon, duke of Condé, the governor of the place who viewed it for ſeveral hours with the greateſt aſtoniſhment.

This light was obſerved to be whitiſh; and not to cover the whole ſurface of the fleſh, but certain parts only, as if gems of unequal ſplendor had been ſcattered over it. This fleſh was kept till it began to putrify, when the light vaniſhed; which, as ſome religious people fancied, it did in the form of a croſs.

Works, vol. iii. p. 156.

It is natural to expect, that the almoſt univerſal experimental philoſopher Mr Boyle ſhould try the effect of his air-pump upon theſe luminous ſubſtances. Accordingly we find that he did not fail to do it; when he preſently found that the light of rotten wood was extinguiſhed *in vacuo,* and revived again on the admiſſion of the air, even after a long continuance *in vacuo;* but the extinguiſhing of this light was not ſo complete immediately upon exhauſting the receiver, as ſome little time afterwards. He could not perceive, however, that the light of rotten wood was increaſed in condenſed air; but this, he imagined, might ariſe from his not being able to judge very well of the degree of light, through ſo thick and cloudy a glaſs-veſſel as he then made uſe of; but we find that the light of a ſhining fiſh, which was put into a condenſing engine before the Royal Society, in 1668, was rendered more vivid by that means. The principal of Mr Boyle's experiments were made in October 1667.

Birch's hiſt. ii. 254.

This philoſopher attended to a great variety of circumſtances relating to this curious phenomenon. Among other things he obſerved, that change of air was not neceſſary to the maintenance of this light; for it continued a long time when a piece of the wood was put into a very ſmall glaſs hermetically ſealed, and it made no difference when this tube which contained the wood was put into an exhauſted receiver. This he alſo obſerved with reſpect to a luminous fiſh, which he put into water, and placed in the ſame circumſtances. He alſo found, that the light of ſhining fiſhes had other properties in common with that of ſhining wood; but the latter, he ſays, was preſently quenched with water, ſpirit of wine, a great variety of ſaline mixtures, and other fluids. Water, however, did not quench all the light of ſome ſhining veal on which he tried it, though ſpirit of wine deſtroyed its virtue preſently.

Mr Boyle's obſervation of light proceeding from fleſh-meat was quite caſual. On the 15th of February 1662, one of his ſervants was greatly alarmed with the ſhining of ſome veal, which had been kept a few days, but had no bad ſmell, and was in a ſtate very proper for uſe. The ſervant immediately made his maſter acquainted with this extraordinary appear-

Birch, ii. 70.

ance; and though he was then in bed, he ordered it to be immediately brought to him, and he examined it with the greateſt attention. Suſpecting that the ſtate of the atmoſphere had ſome ſhare in the production of this phenomenon, he takes notice, after deſcribing the appearance, that the wind was ſouth-weſt and bluſtering, the air hot for the ſeaſon, the moon was paſt its laſt quarter, and the mercury in the barometer was at $29\frac{3}{16}$ inches.

35 Light from fiſhes.

Mr Boyle was often diſappointed in his experiments on ſhining fiſhes; finding that they did not always ſhine in the very ſame circumſtances, as far as he could judge, with others which had ſhined before. At one time that they failed to ſhine, according to his expectations, he obſerved that the weather was variable, and not without ſome days of froſt and ſnow. In general he made uſe of whitings, finding them the fitteſt for his purpoſe. In a diſcourſe, however, upon this ſubject at the Royal Society in 1681, it was aſſerted, that, of all fiſhy ſubſtances, the eggs of lobſters, after they had been boiled, ſhone the brighteſt.

Act. Hafn. vol. v. p. 282.

Olig. Jacobæus obſerves, that upon opening a ſea-polypus, it was ſo luminous, as to ſtartle ſeveral perſons who ſaw it; and he ſays, that the more putrid the fiſh was, the more luminous it grew. The nails alſo, and the fingers of the perſons who touched it, became luminous; and the black liquor which iſſued from the animal, and which is its bile, ſhone, but with a very faint light.

Mr Boyle draws a minute compariſon between the light of burning coals and that of ſhining wood or fiſh, ſhowing in what particulars they agree, and in what they differ. Among other things he obſerves, that extreme cold extinguiſhes the light of ſhining wood, as appeared when a piece of it was put into a glaſs tube, and held in a frigoric mixture. He alſo found that rotten wood did not waſte itſelf by ſhining, and that the application of a thermometer to it did not diſcover the leaſt degree of heat.

36 Of the pholas, a remarkably luminous fiſh.

There is a remarkable ſhell-fiſh, called PHOLAS, which forms for itſelf holes in various kinds of ſtone, &c. That this fiſh is luminous, was noticed by Pliny; who obſerves, that it ſhines in the mouth of the perſon who eats it, and, if it touch his hands or clothes, makes them luminous. He alſo ſays, that the light depends upon its moiſture. The light of this fiſh has furniſhed matter for various obſervations and experiments to M. Reaumur, and the Bolognian academicians, eſpecially Beccarius, who took ſo much pains with the ſubject of phoſphoreal light.

M. Reaumur obſerves, that, whereas other fiſhes give light when they tend to putreſcence, this is more luminous in proportion to its being freſh; that when they are dried, their light will revive if they be moiſtened either with freſh or ſalt water, but that brandy immediately extinguiſhes it. He endeavoured to make this light permanent, but none of his ſchemes ſucceeded.

The attention of the Bolognian academicians was engaged to this ſubject by M. F. Marſilius, in 1724, who brought a number of theſe fiſhes, and the ſtones in which they were incloſed, to Bologna, on purpoſe for their eximanation.

Com. Bonon. vol. ii. 232.

Beccarius obſerved, that though this fiſh ceaſed to ſhine when it became putrid; yet that in its moſt putrid ſtate, it would ſhine, and make the water in which it was immerſed luminous, when they were agitated. Galeatius and Montius found, that wine or vinegar extinguiſhed this light: and that in common oil it continued ſome days; but in rectified ſpirit of wine or urine, hardly a minute.

In order to obſerve in what manner this light was affected by different degrees of heat, they made uſe of a Reaumur's thermometer, and found that water made luminous by theſe fiſhes increaſed in light till the heat arrived to 45 degrees; but that it then became ſuddenly extinct, and could not be revived.

In the experiments of Beccarius, a ſolution of ſea-ſalt increaſed the light of luminous water, a ſolution of nitre did not increaſe it quite ſo much. Sal ammoniac diminiſhed it a little, oil of tartar *per deliquium* nearly extinguiſhed it, and the acids entirely. This water poured upon freſh calcined gypſum, rock cryſtal, ceruſs, or ſugar, became more luminous. He alſo tried the effects of it when tried upon various other ſubſtances, but there was nothing very remarkable in them. Afterwards uſing luminous milk, he found that oil of vitriol extinguiſhed the light, but that oil of tartar increaſed it.

This gentleman had the curioſity to try how differently coloured ſubſtances were affected by this kind of light; and having, for this purpoſe, dipped ſeveral ribbons in it, the white came out the brighteſt, next to this was the yellow, and then the green; the other colours could hardly be perceived. It was not, however, any particular colour, but only light that was perceived in this caſe. He then dipped boards painted with the different colours, and alſo glaſs tubes, filled with ſubſtances of different colours, in water rendered luminous by the fiſhes. In both theſe caſes the red was hardly viſible, the yellow was the brighteſt, and the violet the dulleſt. But on the boards the blue was nearly equal to the yellow, and the green the more languid; whereas in the glaſſes, the blue was inferior to the green.

Of all the liquors into which he put the pholades, milk was rendered the moſt luminous. A ſingle pholas made ſeven ounces of milk ſo luminous, that the faces of perſons might be diſtinguiſhed by it, and it looked as if it was tranſparent.

Air appeared to be neceſſary to this light: for when Beccarius put the luminous milk into glaſs tubes, no agitation would make it ſhine unleſs bubbles of air were mixed with it. Alſo Montius and Galeatius found, that in an exhauſted receiver, the pholas loſt its light, but the water was ſometimes made more luminous; which they aſcribed to the riſing of bubbles of air through it.

Beccarius, as well as Reaumur, had many ſchemes to render the light of theſe pholades permanent. For this purpoſe he kneaded the juice into a kind of paſte, with flour, and found that it would give light when it was immerſed in warm water; but it anſwered beſt to preſerve the fiſh in honey. In any other method of preſervation, the property of becoming luminous would not continue longer than ſix months, but in honey it laſted above a year; and then it would, when plunged in warm water, give as much light as ever it had done.

Acta Cajarenſia, vol. v. p. 485.

Similar, in ſome reſpects, to thoſe obſervations on the light of the pholas, was that which was obſerved to proceed from wood which was moiſt, but not in a putrid ſtate, which was very conſpicuous in the dark.

37
Light from ſea-water.

That the ſea is ſometimes luminous, eſpecially when it is put in motion by the daſhing of oars or the beating of it againſt a ſhip, has been obſerved with admiration by a great number of perſons. Mr Boyle, after reciting all the circumſtances of this appearance, as far as he could collect them from the accounts of navigators; as its being extended as far as the eye could reach, and at other times being viſible only when the water was daſhed againſt ſome other body; that, in ſome ſeas, this phenomenon is accompanied by ſome particular winds, but not in others; and that ſometimes one part of the ſea will be luminous, when another part, not far from it, will not be ſo; concludes with ſaying, that he could not help ſuſpecting that theſe odd phenomena, belonging to great maſſes of water, were in ſome meaſure owing to ſome coſmical law or cuſtom of the terreſtrial globe, or at leaſt of the planetary vortex.

38
Dr Beal's experiments on fiſhes.

Some curious obſervations on the ſhining of ſome fiſhes, and the pickle in which they were immerſed, were made by Dr Beal, in May 1665; and had they been properly attended to and purſued, might have led to the diſcovery of the cauſe of this appearance. Having put ſome boiled mackerel into water, together with ſalt and ſweet herbs; when the cook was, ſome time after, ſtirring it, in order to take out ſome of the fiſhes, ſhe obſerved, that, at the firſt motion, the water was very luminous; and that the fiſh ſhining through the water added much to the light which the water yielded. The water was of itſelf thick and blackiſh, rather than of any other colour; and yet it ſhined on being ſtirred, and at the ſame time the fiſhes appeared more luminous than the water. Wherever the drops of this water, after it had been ſtirred, fell to the ground, they ſhined; and the children in the family diverted themſelves with taking the drops, which were as broad as a penny, and running with them about the houſe. The cook obſerved, that when ſhe turned up that ſide of the fiſh that was loweſt, no light came from it; and that, when the water had ſettled for ſome time, it did not ſhine at all. The day following, the water gave but little light, and only after a briſk agitation, though the fiſhes continued to ſhine as well from the inſide as the outſide, and eſpecially about the throat, and ſuch places as ſeemed to have been a little broken in the boiling.

Phil. Tranſ. vol. lix. p. 450.

When, in the light of the ſun, he examined, with a microſcope, a ſmall piece of a fiſh which had ſhined very much the night before, he found nothing remarkable on its ſurface, except that he thought he perceived what he calls a *ſteam*, rather dark than luminous, ariſing like a very ſmall duſt from the fiſh, and here and there a very ſmall and almoſt imperceptible ſparkle. Of the ſparkles he had no doubt; but he thought it poſſible that the ſteam might be a deception of the ſight, or ſome duſt in the air.

Finding the fiſh to be quite dry, he moiſtened it with his ſpittle; and then obſerved that it gave a little light, though but for a ſhort time. The fiſh at that time was not fetid, nor yet inſipid to the beſt diſcerning palate. Two of the fiſhes he kept two or three days longer for farther trial: but, the weather being very hot, they became fetid; and, contrary to his expectations, there was no more light produced either by the agitation of the water or in the fiſh.

39
Father Bourzes's account of luminous ſea-water.

Father Bourzes, in his voyage to the Indies in 1704, took particular notice of the luminous appearance of the ſea. The light was ſometimes ſo great, that he could eaſily read the title of a book by it, though he was nine or ten feet from the ſurface of the water. Sometimes he could eaſily diſtinguiſh, in the wake of the ſhip, the particles that were luminous from thoſe that were not; and they appeared not to be all of the ſame figure. Some of them were like points of light, and others ſuch as ſtars appear to the naked eye. Some of them were like globes, of a line or two in diameter; and others as big as one's head. Sometimes they formed themſelves into ſquares of three or four inches long, and one or two broad. Sometimes all theſe different figures were viſible at the ſame time; and ſometimes there were what he calls *vortices* of light, which at one particular time appeared and diſappeared immediately like flaſhes of lightning.

Nor did only the wake of the ſhip produce this light, but fiſhes alſo in ſwimming, left ſo luminous a track behind them, that both their ſize and ſpecies might be diſtinguiſhed by it. When he took ſome of the water out of the ſea, and ſtirred it ever ſo little with his hand, in the dark, he always ſaw in it an infinite number of bright particles; and he had the ſame appearance whenever he dipped a piece of linen in the ſea, and wrung it in a dark place, even though it was half dry; and he obſerved, that when the ſparkles fell upon any thing that was ſolid, it would continue ſhining for ſome hours together.

40
His conjectures concerning the cauſe.

After mentioning ſeveral circumſtances which did not contribute to this appearance, this Father obſerves, that it depends very much upon the *quality of the water*; and he was pretty ſure that this light is the greateſt when the water is fatteſt, and fulleſt of foam. For in the main ſea, he ſays, the water is not every where equally pure; and that ſometimes, if linen be dipped in the ſea, it is clammy when it is drawn up again: and he often obſerved, that when the wake of the ſhip was the brighteſt, the water was the moſt fat and glutinous, and that linen moiſtened with it produced a great deal of light; if it was ſtirred or moved briſkly. Beſides, in ſome parts of the ſea, he ſaw a ſubſtance like ſaw-duſt, ſometimes red and ſometimes yellow; and when he drew up the water in thoſe places, it was always viſcous and glutinous. The ſailors told him, that it was the ſpawn of whales; that there are great quantities of it in the north; and that ſometimes, in the night, they appeared all over of a bright light, without being put in motion by any veſſel or fiſh paſſing by them.

As a confirmation of this conjecture, that the more glutinous the ſea-water is, the more it is diſpoſed to become luminous, he obſerves, that one day they took a fiſh which was called a *bonite*, the inſide of the mouth of which was ſo luminous, that without any other light, he could read the ſame characters which he had before read by the light in the wake of the ſhip; and the mouth of this fiſh was full of a viſcous matter, which, when it was rubbed upon a piece of wood, made it immediately all over luminous; though, when the moiſture was dried up, the light was extinguiſhed.

The abbe Nollet was much ſtruck with the lumi-

41 Abbe Nollet's theory.

nouſneſs of the ſea when he was at Venice in 1749 ; and after taking a great deal of pains to aſcertain the circumſtances of it, concluded that it was occaſioned by a ſhining inſect ; and having examined the water very often, he at length did find a ſmall inſect, which he particularly deſcribes, and to which he attributes the light. The ſame hypotheſis had alſo occured to M. Vianelli, profeſſor of medicine in Chioggia near Venice ; and both he and M. Grizellini, a phyſician in Venice, have given drawings of the inſect from which they imagined this light to proceed.

The abbé was the more confirmed in his hypotheſis, by obſerving, ſome time after, the motion of ſome luminous particles in the ſea. For going into the water, and keeping his head juſt above the ſurface, he ſaw them dart from the bottom, which was covered with weeds, to the top, in a manner which he thought very much reſembled the motions of inſects ; though, when he endeavoured to catch them, he only found ſome luminous ſpots upon his hankerchief, which were enlarged when he preſſed them with his finger.

42 Obſervations of M. le Roi.

M. le Roi, making a voyage on the Mediterranean, preſently after the abbe Nollet made his obſervations at Venice, took notice, that in the day-time, the prow of the ſhip in motion threw up many ſmall particles, which, falling upon the water, rolled upon the ſurface of the ſea for a few ſeconds before they mixed with it ; and in the night the ſame particles, as he concluded, had the appearance of fire. Taking a quantity of the water, the ſame ſmall ſparks appeared whenever it was agitated ; but as was obſerved with reſpect to Dr Beal's experiments, every ſucceſſive agitation produced a leſs effect than the preceding, except after being ſuffered to reſt a while ; for then a freſh agitation would make it almoſt as luminous as the firſt. This water, he obſerved, would retain its property of ſhining by agitation a day or two ; but it diſappeared immediately on being ſet on the fire, though it was not made to boil.

Memoires Preſentes, vol. iii. 144.

This gentleman, after giving much attention to this phenomenon, concludes, that it is not occaſioned by any ſhining inſects, as the abbe Nollet imagined ; eſpecially as, after carefully examining ſome of the luminous points, which he caught upon an hankerchief, he found them to be round like large pins heads, but with nothing of the appearance of any animal, though he viewed them with a microſcope. He alſo found, that the mixture of a little ſpirit of wine with water juſt drawn from the ſea, would give the appearance of a great number of little ſparks, which would continue viſible longer than thoſe in the ocean. All the acids, and various other liquors, produced the ſame effect, though not quite ſo conſpicuouſly ; but no freſh agitation would make them luminous again. M. le Roi is far from aſſerting that there are no luminous inſects in the ſea. He even ſuppoſes that the abbe Nollet and M. Vianelli had found them. But he was ſatisfied that the ſea is luminous chiefly on ſome other account, though he does not ſo much as advance a conjecture about what it is.

43 Experiments by M. Ant. Martin.

M. Ant. Martin made many experiments on the light of fiſhes, with a view to diſcover the cauſe of the light of the ſea. He thought that he had reaſon to conclude, from a great variety of experiments, that all ſea-fiſhes have this property ; but that it is not to be found in any that are produced in freſh water. Nothing depended upon the *colour* of the fiſhes, except that he thought that the white ones, and eſpecially thoſe that had white ſcales, were a little more luminous than others. This light, he found, was increaſed by a ſmall quantity of ſalt ; and alſo by a ſmall degree of warmth, though a greater degree extinguiſhed it. This agrees with another obſervation of his, that it depends entirely upon a kind of moiſture which they had about them, and which a ſmall degree of heat would expel, when an oilineſs remained which did not give this light, but would burn in the fire. Light from the fleſh of birds or beaſts is not ſo bright, ſays he, as that which proceeds from fiſh. Human bodies, he ſays, have ſometimes emitted light about the time that they began to putrefy, and the walls and roof of a place in which dead bodies had often been expoſed, had a kind of a dew or clammineſs upon it, which was ſometimes luminous ; and he imagined that the lights which are ſaid to be ſeen in burying-grounds may be owing to this cauſe.

Swed. Abhand. vol. xxiii. p. 215.

44 By Mr Canton.

From ſome experiments made by Mr Canton, he concludes, that the luminouſneſs of ſea-water is owing to the ſlimy and other putreſcent ſubſtances it contains. On the evening of the 14th of June 1768, he put a ſmall freſh whiting into a gallon of ſea-water, in a pan which was about 14 inches in diameter, and took notice that neither the whiting nor the water, when agitated, gave any light. A Fahrenheit's thermometer, in the cellar where the pan was placed, ſtood at 54°. The 15th, at night, that part of the fiſh which was even with the ſurface of the water was luminous, but the water itſelf was dark. He drew the end of a ſtick through it, from one ſide of the pan to the other ; and the water appeared luminous behind the ſtick all the way, but gave light only where it was diſturbed. When all the water was ſtirred, the whole became luminous, and appeared like milk, giving a conſiderable degree of light to the ſides of the pan ; and it continued to do ſo for ſome time after it was at reſt. The water was moſt luminous when the fiſh had been in it about 28 hours ; but would not give any light by being ſtirred, after it had been in it three days.

He then put a gallon of freſh water into one pan, and an equal quantity of ſea-water into another, and into each pan he put a freſh herring of about three ounces. The next night the whole ſurface of the ſea-water was luminous, without being ſtirred ; but it was much more ſo when it was put in motion ; and the upper part of the herring, which was conſiderably below the ſurface of the water, was alſo very bright ; while at the ſame time, the freſh water, and the fiſh that was in it, were quite dark. There were ſeveral very bright luminous ſpots on different parts of the ſurface of the ſea-water ; and the whole, when viewed by the light of a candle, ſeemed covered with a greaſy ſcum. The third night, the light of the ſea-water, while at reſt, was very little, if at all, leſs than before ; but when ſtirred, its light was ſo great as to diſcover the time by a watch, and the fiſh in it appeared as a dark ſubſtance. After this, its light was evidently decreaſing, but was not quite gone before the 7th night.

The freſh water and the fiſh in it were perfectly dark during the whole time. The thermometer was generally above 60°.

The preceding experiments were made with ſea-water: but he now made uſe of other water, into which he put common or ſea-ſalt, till he found, by an hydrometer, that it was of the ſame ſpecific gravity with the ſea-water; and, at the ſame time, in another gallon of water, he diſſolved two pounds of ſalt; and into each of theſe waters he put a ſmall freſh herring. The next evening the whole ſurface of the artificial ſea-water was luminous without being ſtirred; but gave much more light when it was diſturbed. It appeared exactly like the real ſea-water in the preceding experiment; its light laſted about the ſame time, and went off in the ſame manner: while the other water, which was almoſt as ſalt as it could be made, never gave any light. The herring which was taken out of it the ſeventh night, and waſhed from its ſalt, was found firm and ſweet; but the other herring was very ſoft and putrid, much more ſo than that which had been kept as long in freſh water. If a herring, in warm weather, be put into 10 gallons of artificial ſea-water, inſtead of one, the water, he ſays, will ſtill become luminous, but its light will not be ſo ſtrong.

It appeared by ſome of the firſt obſervations on this ſubject, that *heat* extinguiſhes the light of putreſcent ſubſtances. Mr Canton alſo attended to this circumſtance; and obſerves, that though the greateſt ſummer heat is well known to promote putrefaction, yet 20 degrees more than that of the human blood ſeems to hinder it. For putting a ſmall piece of a luminous fiſh into a thin glaſs ball, he found, that water of the heat of 118 degrees would extinguiſh its light in leſs than half a minute; but that, on taking it out of the water, it would begin to recover its light in about 10 ſeconds; but it was never afterwards ſo bright as before.

Mr Canton made the ſame obſervation that Mr Ant. Martin had done, *viz.* that ſeveral kinds of river fiſh could not be made to give light, in the ſame circumſtances in which any ſea-fiſh become luminous. He ſays, however, that a piece of carp made the water very luminous, though the outſide, or ſcaly part of it, did not ſhine at all.

For the ſake of thoſe perſons who may chooſe to repeat his experiments, he obſerves, that artificial ſea-water may be made without the uſe of an hydrometer, by the proportion of four ounces avoirdupoiſe of ſalt to ſeven pints of water, wine-meaſure.

45 The ocean luminous from inſects. From undoubted obſervations, however, it appears, that in many places of the ocean it is covered with luminous inſects to a very conſiderable extent. Mr Dagelet, a French aſtronomer who returned from the Terra Auſtralis in the year 1774, brought with him ſeveral kinds of worms which ſhine in water when it is ſet in motion; and M. Rigaud, in a paper inſerted (if we are not miſtaken) in the Journal des Sçavans for the month of March 1770, affirms, that the luminous ſurface of the ſea, from the port of Breſt to the Antilles, contains an immenſe quantity of little, round, ſhining polypuſes of about a quarter of a line in diameter. Other learned men, who acknowledge the exiſtence of theſe luminous animals, cannot, however, be perſuaded to conſider them as the cauſe of all that light and ſcintillation that appear on the ſurface of the ocean: they think that ſome ſubſtance of the phoſphorus kind, ariſing from putrefaction, muſt be admitted as one of the cauſes of this phenomenon. M. Godehoue has publiſhed curious obſervations on a kind of fiſh called in French *bonite*, already mentioned; and though he has obſerved, and accurately deſcribed, ſeveral of the luminous inſects that are found in ſea-water, he is, nevertheleſs, of opinion, that the ſcintillation and flaming light of the ſea proceed from the oily and greaſy ſubſtances with which it is impregnated.

The abbé Nollet was long of opinion, that the light of the ſea proceeded from electricity (A); though he afterwards ſeemed inclined to think, that this phenomenon was cauſed by ſmall animals, either by their luminous aſpect, or at leaſt by ſome liquor or effluvia which they emitted. He did not, however, exclude other cauſes; among theſe, the ſpawn or fry of fiſh deſerves to be noticed. M. Dagelet, ſailing into the bay of Antongil, in the *iſland* of Madagaſcar, obſerved a prodigious quantity of fry, which covered the ſurface of the ſea above a mile in length, and which he at firſt took for banks of ſand on account of their colour; they exhaled a diſagreeable odour, and the ſea had appeared with uncommon ſplendor ſome days before. The ſame accurate obſerver, perceiving the ſea remarkably luminous in the road of the Cape of Good Hope during a perfect calm, remarked, that the oars of the canoes produced a whitiſh and pearly kind of luſtre; when he took in his hand the water which contained this phoſphorus, he diſcerned in it, for ſome minutes, globules of light as large as the heads of pins. When he preſſed theſe globules, they appeared to the touch like a ſoft and thin pulp; and ſome days after the ſea was covered near the coaſts with whole banks of theſe little fiſh in innumerable multitudes.

46 *Ignis fatuus.* To putrefaction, alſo, ſome are willing to attribute that luminous appearance which goes by the name of *ignis fatuus*, to which the credulous vulgar aſcribe very extraordinary and eſpecially miſchievous powers. It is moſt frequently obſerved in boggy places and near rivers, though ſometimes alſo in dry places. By its appearance benighted travellers are ſaid to have been ſometimes miſled into marſhy places, taking the light which they ſaw before them for a candle at a diſtance; from which ſeemingly miſchievous property it has been thought by the vulgar to be a ſpirit of a malignant nature, and been named accordingly *Will with a wiſp*, or *Jack with a lanthorn*; for the ſame reaſon alſo it probably had its Latin name *ignis fatuus*.

This kind of light is ſaid to be frequent about burying places and dung-hills. Some countries are alſo remarkable for it, as about Bologna in Italy, and ſome parts of Spain and Ethiopia. Its forms are ſo uncertain and variable that they can ſcarce be deſcribed, eſpecially as few philoſophical obſervers ever had the good fortune to meet with it. Dr Derham, however, happened

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(A) This hypotheſis was alſo maintained in a treatiſe publiſhed at Venice in 1746, by an officer in the Auſtrian ſervice, under the title, *Dell' Eletreciſmo.*

happened one night to perceive one of them, and got ſo near that he could have a very advantageous view of it. This is by no means eaſy to be obtained; for, among other ſingularities of the *ignus fatuus*, it is obſerved to avoid the approach of any perſon, and fly from place to place as if it was animated. That which Dr Derham obſerved was in ſome boggy ground betwixt two rocky hills; and the night was dark and calm; by which means, probably, he was enabled to advance within two or three yards of it. It appeared like a complete body of light without any diviſion, ſo that he was ſure it could not be occaſioned by inſects as ſome have ſuppoſed; the ſeparate lights of which he could not have failed to diſtinguiſh, had it been occaſioned by them. The light kept dancing about a dead thiſtle, till a very ſlight motion of the air, occaſioned, as he ſuppoſed, by his near approach to it, made it jump to another place; after which it kept flying before him as he advanced. M. Beccari endeavoured to procure all the intelligence he could concerning this phenomenon, by enquiring of all his acquaintance who might have had an opportunity of obſerving it. Thus he obtained information that two of theſe lights appeared in the plains about Bologna, the one to the north, and the other to the ſouth, of that city, and were to be ſeen almoſt every dark night, eſpecially that to the eaſtward, giving a light equal to an ordinary faggot. The latter appeared to a gentleman of his acquaintance as he was travelling; moved conſtantly before him for about a mile; and gave a better light than a torch which was carried before him. Both theſe appearances gave a very ſtrong light, and were conſtantly in motion though this was various and uncertain. Sometimes they would riſe, ſometimes ſink; but commonly they would hover about ſix feet from the ground; they would alſo frequently diſappear on a ſudden, and appear again in ſome other place. They differed alſo in ſize and figure, ſometimes ſpreading pretty wide, and then contracting themſelves; ſometimes breaking into two, and then joining again. Sometimes they would appear like waves, at others they would ſeem to drop ſparks of fire: they were but little affected by the wind; and in wet and rainy weather were frequently obſerved to caſt a ſtronger light than in dry weather: they were alſo obſerved more frequently when ſnow lay upon the ground, than in the hotteſt ſummer; but he was aſſured that there was not a dark night throughout the whole year in which they were not to be ſeen. The ground to the eaſtward of Bologna, where the largeſt of theſe appearances was obſerved, is a hard chalky ſoil mixed with clay, which will retain the moiſture for a long time, but breaks and cracks in hot weather. On the mountains, where the ſoil is of a loſer texture, and leſs capable of retaining moiſture, the *ignes fatui* were leſs.

From the beſt information which M. Beccari was able to procure, he found that theſe lights were very frequent about rivers and brooks. He concludes his narrative with the following ſingular account. "An intelligent gentleman travelling in the evening, between eight and nine, in a mountanous road about ten miles ſouth of Bologna, perceived a light which ſhone very ſtrangely upon ſome ſtones which lay on the banks of the river Rioverde. It ſeemed to be about two feet above the ſtones, and not far from the water. In ſize and figure it had the appearance of a parallelopiped, ſomewhat more than a foot in length, and a half a foot high, the longeſt ſide being parallel to the horizon. Its light was ſo ſtrong, that he could plainly diſcern by it part of a neighbouring hedge and the water of the river; only in the eaſt corner of it the light was rather faint, and the ſquare figure leſs perfect, as if it was cut off or darkened by the ſegment of a circle. On examining it a little nearer, he was ſurpriſed to find that it changed gradually from a bright red, firſt to a yellowiſh, and then to a pale colour, in proportion as he drew nearer; and when he came to the place itſelf, it quite vaniſhed. Upon this he ſtepped back, and not only ſaw it again, but found that the farther he went from it, the ſtronger and brighter it grew. When he examined the place of this luminous appearance, he could perceive no ſmell nor any other mark of fire." This account was confirmed by another gentleman, who informed M. Beccari, that he had ſeen the ſame light five or ſix different times in ſpring and in autumn; and that it always appeared of the ſame ſhape, and in the very ſame place. One night in particular, he obſerved it come out of a neighbouring field to ſettle in the uſual place.

A very remarkable account of an *ignis fatuus* is given by Dr Shaw in his Travels to the Holy Land. It appeared in the valleys of mount Ephraim, and attended him and his company for more than an hour. Sometimes it would appear globular, or in the ſhape of the flame of a candle; at others it would ſpread to ſuch a degree as to involve the whole company in a pale inoffenſive light, then contract itſelf, and ſuddenly diſappear; but in leſs than a minute would appear again; ſometimes running ſwiftly along, it would expand itſelf at certain intervals over more than two or three acres of the adjacent mountains. The atmoſphere from the beginning of the evening had been remarkably thick and hazy; and the dew, as they felt it on the bridles of their horſes, was very clammy and unctuous.

Lights reſembling the *ignis fatuus* are ſometimes obſerved at ſea, ſkipping about the maſts and rigging of ſhips; and Dr Shaw informs us, that he has ſeen theſe in ſuch weather as that juſt mentioned when he ſaw the *ignis fatuus* in Paleſtine. Similar appearances have been obſerved in various other ſituations; and we are told of one which appeared about the bed of a woman in Milan, ſurrounding it as well as her body entirely. This light fled from the hand which approached it; but was at length entirely diſperſed by the motion of the air. Of the ſame kind alſo, moſt probably, are thoſe ſmall luminous appearances which ſometimes appear in houſes or near them, called in Scotland *Elf-candles*, and which are ſuppoſed to portend the death of ſome perſon about the houſe. In general theſe lights are harmleſs, though not always; for we have accounts of ſome luminous vapours which would encompaſs ſtacks of hay and corn, and ſet them on fire; ſo that they became objects of great terror and concern to the country people. Of theſe it was obſerved, that they would avoid a drawn ſword, or ſharp-pointed iron inſtrument, and that they would be driven away by a great noiſe; both which methods were made uſe of to diſſipate them; and it was likewiſe obſerved, that they came from ſome diſtance, as it were on purpoſe to do miſchief.

Several philoſophers have endeavoured to account for theſe appearances, but hitherto with no great ſucceſs; nor indeed does there ſeem to be ſufficient data for ſolving all their phenomena. Willoughby, Ray, and others, have imagined that the light was occaſioned by a number of ſhining inſects; but this opinion was never ſupported in ſuch a manner as to gain much ground. The *ignis fatuus* ſeen by Dr Derham abovementioned, as well as all the other inſtances we have related, ſeem to demonſtrate the contrary. Sir Iſaac Newton calls it a vapour ſhining without heat; and ſuppoſes that there is the ſame difference between the vapour of *ignis fatuus* and flame, that there is between the ſhining of rotten wood and burning coals. But though this ſeems generally to be the caſe, there are ſtill ſome exceptions, as has been inſtanced in the vapours which ſet fire to the ſtacks of corn. Dr Prieſtley ſuppoſes that the light is of the ſame nature with that produced by putreſcent ſubſtances; and others are of opinion, that the electrical fluid is principally concerned; but none have attempted to give any particular ſolution of the phenomena.

From the frequent appearance of the *ignis fatuus* in marſhes, moiſt ground, burying places and dunghills, we are naturally led to conclude, that putrefaction is concerned in the production of it. This proceſs, we know is attended with the emiſſion of an aqueous ſteam, together with a quantity of fixed, inflammable, phlogiſticated, and alkaline airs, all blended together in the common vapour. It is likewiſe attended with ſome degree of heat: and we know that there are ſome vapours, that of ſulphur particularly, which become luminous, with a degree of heat much leſs than that ſufficient to ſet fire to combuſtible bodies. There is no inconſiſtency, therefore, in ſuppoſing that the putrid vapour may be capable of ſhining with a ſtill ſmaller degree of heat than that of ſulphur, and conſequently become luminous by that which putrefaction alone affords. This would account for the *ignis fatuus*, were it only a ſteady luminous vapour ariſing from places where putrid matters are contained; but its extreme mobility, and flying from one place to another on the approach of any perſon, cannot be accounted for on this principle. If one quantity of the putrid vapour become luminous by means of heat, all the reſt ought to do ſo likewiſe; ſo that though we may allow heat and putrefaction to be concerned, yet of neceſſity we muſt have recourſe to ſome other agent, which cannot be any other than electricity. Without this it is impoſſible to conceive how any body of moveable vapour ſhould not be carried away by the wind: but ſo far is this from being the caſe, that the *ignes fatui* deſcribed by M. Beccari were but little affected by the wind. It is beſides proved by undoubted experiment, that electricity always is attended with ſome degree of heat; and this, however, ſmall, may be ſufficient to give a luminous property to any vapour on which it acts ſtrongly; not to mention, that the electric fluid itſelf is no other than that of light, and may therefore by its action eaſily produce a luminous appearance independent of any vapour.

We have a ſtrong proof that electricity is concerned, or indeed the principal agent, in producing the *ignis fatuus*, from an experiment related by Dr Prieſtley of a flame of this kind being artificially produced. A gentleman, who had been making many electrical experiments for a whole afternoon in a ſmall room, on going out of it, obſerved a flame following him at ſome little diſtance. This we have no reaſon to doubt, was a true *ignis fatuus*, and the circumſtances neceſſary to produce it were then preſent, an atmoſphere impregnated with animal vapour, and likewiſe ſtrongly electrified. Both theſe circumſtances undoubtedly muſt have taken place in the preſent caſe: for the quantity of perſpiration emitted by a human body is by no means inconſiderable; and it as well as the electricity would be collected by reaſon of the ſmallneſs of the room. In this caſe, however, there ſeems to have been a conſiderable difference between the artificial *ignis fatuus* and thoſe commonly met with: for this flame *followed* the gentleman as he went out of the room; but the natural ones commonly fly from thoſe who approach them. This may be accounted for from a difference between the electricity of the atmoſphere in the room and the other; in which caſe the flame would naturally be attracted towards that place where the electricity was either different in quality or in quantity; but in the natural way, where all bodies may be ſuppoſed equally electrified for a great way round, a repulſion will as naturally take place. Still, however, this does not ſeem to be always the caſe. In thoſe inſtances where travellers have been attended by an *ignis fatuus*, we cannot ſuppoſe it to have been influenced by any other power than what we call *attraction*, and which electricity is very capable of producing. Its keeping at ſome diſtance is likewiſe eaſily accounted for, as we know that bodies poſſeſſed of different quantities of electricity may be made to attract one another for a certain ſpace, and then repel without having ever come into contact. On this principle we may account for the light which ſurrounded the woman at Milan, but fled from the hand of any other perſon. On the ſame principle may we account for theſe miſchievous vapours which ſet fire to the hay and corn ſtacks, but were driven away by preſenting to them a pointed iron inſtrument, or by making a noiſe. Both theſe are known to have a great effect upon the electric matter; and by means of either, even lightning may occaſionally be made to fall upon or to avoid particular places, according to the circumſtances by which the general maſs happens to be affected at that time.

On the whole, therefore, it ſeems moſt probable, that the *ignis fatuus* is a collection of vapour of the putreſcent kind, very much affected by electricity; according to the degree of which, it will either give a weak or ſtrong light, or even ſet fire to certain ſubſtances diſpoſed to receive its operation. This opinion ſeems greatly to be confirmed from ſome luminous appearances, obſerved in privies, where the putrid vapours have even collected themſelves into balls, and exploded violently on the approach of a candle. This laſt effect, however, we cannot ſo well aſcribe to the electricity, as to the aſcenſion of the inflammable air which frequently abounds in ſuch places.

In the appendix to Dr Prieſtley's third volume of experiments and obſervations on air, Mr Warltire gives an account of ſome very remarkable *ignes fatui*, which he obſerved on the road to Bromſgrove, about five miles from Birmingham. The time of obſervation was the 12th of December 1776, before day-light. A great many of theſe lights were playing in an adjacent field, in different directions; from ſome of which there ſuddenly ſprung up bright branches of light, ſomething reſembling the exploſion of a rocket that contained many brilliant ſtars, if the diſcharge was upwards inſtead of the uſual direction, and the hedge and trees on each ſide of the hedge were illuminated. This appearance continued but a few ſeconds, and then the jack-a-lanterns played as before. Mr Warltire was not near enough to obſerve if the apparent exploſions were attended with any report.

Crouſtedt gives it as his opinion, that *ignes fatui*, as well as the meteors called *falling ſtars*, are owing to collections of inflammable air raiſed to a great height in the atmoſphere. But, with regard to the latter, the vaſt height at which they move evidently ſhows that they cannot be the effect of any *gravitating* vapour whatever; for the lighteſt inflammable air is one-twelfth of that of the common atmoſphere: and we have no reaſon to believe, that at the diſtance of 40 or 50 miles from the earth, the latter has near $\frac{1}{12}$ of its weight at the ſurface. From the account given by Mr Warltire, we ſhould be apt to conclude, that there is a ſtrong affinity betwixt the *ignes fatui* and fire-balls, inſomuch that the one might be very eaſily converted into the other. From this then we muſt aſcribe an electrical origin to the one as well as the other. Electricity, we know, can aſſume both theſe appearances, as is evident in the caſe of points; or even when the atmoſphere is violently electrified, as around the ſtring of an electrical kite, which always will appear to be ſurrounded with a blue flame in the night, if the electrity be very ſtrong.

On the whole, it appears, that electricity acting upon a ſmall quantity of atmoſpherical air, with a certain degree of vigour, will produce an appearance reſembling an *ignis fatuus*; with a ſuperior force it will produce a fire-ball, and a ſudden increaſe of electrical power might produce thoſe ſparks and apparent exploſions obſerved by Mr Warltire. The only difficulty therefore is, Why does electricity exert its power upon one portion of the atmoſphere rather than another, ſeeing it has an opportunity of diffuſing itſelf equally through the whole? To this it ſeems impoſſible to give any farther reaſon than that we ſee the fact is ſo; and that in all caſes where there is a quantity of electrified air or vapour, there will be an accumulation in one part rather than another. Thus, in the experiment already related, where the gentleman perceived a blue flame following him, the whole air of the room was electrified, but the greateſt power of the fluid was exerted on that which gave the luminous appearance.

With regard to the uſes of the *ignes fatui* in the ſyſtem of nature, we can only ſay, that they ſeem to be accidental appearances reſulting from the motion of the electric fluid, and are no doubt like other meteors, ſubſervient to the preſervation of its equilibrum, and thus are uſeful in preventing thoſe dreadful commotions which enſue when a proper medium for ſo doing is deficient.

47 Phoſphoric light.

A light in ſome reſpects ſimilar to thoſe above mentioned has been found to proceed from that celebrated chemical production called *phoſphorus*, which always tends to decompoſe itſelf, ſo as to take fire by the acceſs of *air* only. Phoſphorus, therefore when it emits light, is properly a body ignited; though when a very ſmall quantity of it is uſed, as what is left after drawing it over paper, or what may be diſſolved in eſſential oil, the heat is not ſenſible. But perhaps the matter which emits the light, in what we call *putreſcent ſubſtances*, may be ſimilar to it, though it be generated by a different proceſs, and burn with a leſs degree of heat. Putreſcence does not ſeem to be neceſſary to the light of glow-worms, or of the pholades; and yet their light is ſufficiently ſimilar to that of ſhining wood or fleſh. Electric light is unqueſtionably ſimilar to that of phoſphorus, though the ſource of it is apparently very different.

Kunckel formed his phoſphorus into a kind of pills, about the ſize of peas, which being moiſtened a little and ſcraped in the dark, yielded a very conſiderable light, but not without ſmoke. The light was much more pleaſing when eight or ten of theſe pills were put into a glaſs of water; for being ſhaken in the dark, the whole glaſs ſeemed to be filled with light. Kunckel alſo reduced his phoſphorus into the form of larger ſtones; which being warmed by a perſon's hand, and rubbed upon paper, would deſcribe letters that were very legible in the dark.

The greateſt variety of experiments with the light of phoſphorus was made by Dr Slare; who ſays, that the liquid phoſphorous (which is nothing more than the ſolid phoſphorous diſſolved in any of the eſſential oils), would not hurt even a lady's hand; or that, when the hands or face were waſhed with it, it would not only make them viſible to other perſons in the dark, but that the light was ſo conſiderable as to make other neighbouring objects viſible.

When the ſolid phoſphorus is quite immerſed in water, he obſerves, that it ceaſes to ſhine; but that if any part, of it chance to emmerge or get into the air, it will ſhine though the glaſs be heremetically ſealed. In a large glaſs he kept it without water for ſeveral days; and yet it continued ſhining, with very little diminution of its light or weight. If the letters that were written with this phoſphorus were warmed by the fire, they preſently became dark lines, which continued upon the paper, like ink. To try how much light was given by a ſmall quantity of this phoſphorus, he obſerved that it continued to flame in the open air for ſeven or eight days, the light being viſible whenever he ſhut his window.

As air was generally thought to contain the *pabulum* of flame, Dr Slare was determined to try this with reſpect to phoſphorus; and for this purpoſe he placed a large piece of it in a receiver; but upon exhauſting it, he perceived that it became more luminous, and that upon admitting the air, it returned to its former ſtate. This property of the light of phoſphorus, which is the very reverſe of that of ſhining wood and fiſhes, was alſo aſcertained by ſeveral very accurate experiments of Mr Haukſbee's.

Endeavouring to blow the phoſphorus into a flame with a pair of bellows, Dr Slare found that it was preſently blown out, and that it was a conſiderable time before the light revived again. All liquors would extinguiſh this light when the phoſphorus was put into them; nor would it ſhine or burn, though it was even boiled in the moſt inflammable liquors, as oil of olive, ſpirit of turpentine, or even ſpirit of wine.

In order to keep his phoſphorus from conſuming, he uſed to put it in a glaſs of water; and ſometimes he has ſeen it, when thus immerſed in water, make ſuch bright and vigorous coruſcations in the air, as, he ſays would ſurpriſe and frighten thoſe who are not uſed to the phenomenon. This fiery meteor, he ſays, is contracted in its paſſage through the water, but expands as ſoon as it gets above it. If any perſon would make this experiment to advantage, he informs them that the glaſs muſt be deep, and cylindrical and not above three quarters filled with water. This effect he perceived in warm weather only, and never in cold.

Acta Cæſarienſa, vol. v. p. 334.

The phoſphorus of which we have been treating is prepared from urine; but in ſome caſes the ſweat, which is ſimilar to urine, has been obſerved to be phoſphoraceous; without any preparation. This once happened to a perſon who uſed to eat great quantities of ſalt, and who was a little ſubject to the gout, after ſweating with violent exerciſe. Stripping himſelf in the dark his ſhirt ſeemed to be all on fire, which ſurpriſed him very much. Upon examination, red ſpots were found upon his ſhirt; and the phyſician who was preſent perceived an urinous ſmell, though it had nothing in it of volatile alkali, but of the muriatic acid; the ſame, he ſays, that iſſues from cabbage much ſalted, and ſtrongly fermented.

48
All theſe lights accounted for from electricity.

The eaſieſt method of accounting for all theſe kinds of lights, perhaps, is from electricity. If light conſiſts in a certain vibration of the electric fluid†, then it follows, that in whatever ſubſtances ſuch a vibration takes place, there light muſt appear, whether in putreſcent animal ſubſtances, ſea-water phoſphorus, or any thing elſe. We know that the electric matter pervades all terreſtrial ſubſtances, and is very liable to be ſet in motion from cauſes of which we are ignorant. The action of the air by which putrefaction is produced may be one of theſe cauſes; and it can by no means appear ſurpriſing that the electric matter ſhould act in the bodies of living animals in ſuch a manner as to produce a permanent light, when we certainly know it acts in ſome of them ſo powerfully as to produce a ſhock ſimilar to that of a charged vial.——On this ſubject we ſhall only obſerve farther, that when this vibration becomes ſo powerful as to penetrate the ſolid ſubſtance of the body itſelf, the luminous body then becomes tranſparent, as in the milk mentioned in the former part of this article; but, when it is only ſuperficial, the body, though it emits light, is itſelf opaque.

† See *Electricity*.

Light from diamonds. Among luminous bodies the diamond is to be reckoned; as ſome diamonds are known to ſhine in the dark. But on account of the feebleneſs of their ſplendor, it is neceſſary for the perſon who is to obſerve them, previouſly to ſtay in the dark at leaſt a quarter of an hour; that the pupil of the eye may be dilated and enlarged, and ſo rendered capable of receiving a larger quantity of the rays of light. M. du Fay has alſo obſerved, that the eyes ought to be ſhut for this time, or at leaſt one of them; and that in that caſe, the light of the diamond is afterwards only ſeen by that eye which has been ſhut. Before the diamond is brought into the dark room, it muſt be expoſed to the ſun-ſhine, or at leaſt to the open day light, to imbibe a ſufficient quantity of rays; and this is done in one minute, or even leſs; eight or ten ſeconds having been found to furniſh as much light as the ſtone is capable of receiving; and when brought into the dark, its light continues about twelve or thirteen minutes, weakening all the while by inſenſible degrees. It is very remarkable that in bodies ſo extremely ſimilar to each other as diamonds are, ſome ſhould have this property of imbibing the ſun's rays, and ſhining in the dark, and that others ſhould not; yet ſo it is found to be by experiment, and the moſt nearly reſembling ſtones ſhall be found one to have this property, and another to be deſtitute of it; while many of the moſt diſſimilar have the property in common. There ſeems to be no rule, nor even the leaſt traces of any imperfect rule of judging, which diamonds have, and which have not this property; their natural brightneſs, their purity, their ſize, or their ſhape, contribute nothing to it; and all that has yet ben diſcovered of the leaſt regularity among them, is, that all the yellow diamonds have this property. This may probably ariſe from their having more ſulphur in their compoſition, and therefore illuminating more readily, or emitting a more viſible flame.

The burning of diamonds is a term uſed among the jewellers, for putting them into a fierce fire, as they frequently do, when they are fouled with brown, or yellow, or the like; this always diveſts them of their colour, without doing them the leaſt ſenſible injury. M. du Fay, having been informed of this common practice, formed a conjecture, that the difference of diamonds in their ſhining, or not ſhining in the dark, was owing to it; and that either all thoſe which had been burnt, or all thoſe which had not, were thoſe which alone ſhone in the dark. But this was found an erroneous conjecture; for two diamonds, one lucid in the dark the other not, were both burnt, and afterwards both were found to retain the ſame properties they had before. It is not only the open ſunſhine, or open day-light, which gives to theſe diamonds the power of ſhining in the dark: they receive it in the ſame manner even if laid under a glaſs, or plunged in water or in milk.

M. Du Fay tried whether it was poſſible to make the diamond retain, for any longer time, the light it naturally parts with ſo ſoon; and found, that if the diamond, after being expoſed to the light, be covered with black wax it will ſhine in the dark, as well ſix hours afterwards as at the time it was firſt impregnated with the light.

The imbibing light, in this manner, being ſo nice a property as not to be found in ſeveral diamonds, it was not to be ſuppoſed, that it would be found in any other ſtones: accordingly, on trial, the ruby, the ſapphire, and the topaz, were found wholly deſtitute of it; and among a large number of rough emeralds, one only was found to poſſeſs it. Such is the ſtrange uncertainty of theſe accidents.

All the other leſs precious ſtones were tried and found not to poſſeſs this property of imbibing light from the day-light or ſun-ſhine, but they all became luminous by the different means of heating or friction; with this difference, that ſome acquired it by one of theſe

theſe methods, and others by the other; each being unaffected by that which gave the property to the other. The diamond becomes luminous by all theſe ways.

Beccarius alſo diſcovered, that diamonds have the property of the Bolognian phoſphorus, about the ſame time that it occurred to M. du Fay. *Com. Bonon,* vol. ii. p. 176. M. du Fay likewiſe obſerved, that the common topaz, when calcined, had all the properties of this phoſphorus; and purſuing the diſcovery, he found the ſame property, in a great degree, in the belemnites, gypſum, lime-ſtone, and marble: though he was obliged to diſſolve ſome very hard ſubſtances of this kind in acids, before calcination could produce this change in them; and with ſome ſubſtances he could not ſucceed even thus: eſpecially with flint-ſtones, river-ſand, jaſpers, agates, and rock-cryſtal.

LIGHT *from Plants.* In Sweden a very curious phenomenon has been obſerved on certain flowers by M. Haggern, lecturer in natural hiſtory. One evening he perceived a faint flaſh of light repeatedly dart from a marigold. Surpriſed at ſuch an uncommon appearance, he reſolved to examine it with attention; and to be aſſured it was no deception of the eye, he placed a man near him, with orders to make a ſignal at the moment when he obſerved the light. They both ſaw it conſtantly at the ſame moment.

The light was moſt brilliant on marigolds of an orange or flame colour; but ſcarcely viſible on pale ones.

The flaſh was frequently ſeen on the ſame flower two or three times in quick ſucceſſion; but more commonly at intervals of ſeveral minutes; and when ſeveral flowers in the ſame place emitted their light together, it could be obſerved at a conſiderable diſtance.

This phenomenon was remarked in the months of July and Auguſt at ſun-ſet, and for half an hour, when the atmoſphere was clear; but after a rainy day, or when the air was loaded with vapours, nothing of it was ſeen.

The following flowers emitted flaſhes, more or leſs vivid, in this order:

1. The menigolds, *galendula officinalis.*
2. Monk's-hood, *tropelum majus.*
3. The orange-lily, *lilium bulbiferum.*
4. The Indian pink, *tagetes patula & erecta.*

To diſcover whether ſome little inſects or phoſphorric worms might not be the cauſe of it, the flowers were carefully examined, even with a microſcope, without any ſuch being found.

From the rapidity of the flaſh, and other circumſtances, it may be conjectured that there is ſomething of electricity in this phenomenon. It is well known, that when the piſtil of a flower is impregnated, the pollen burſts away by its elaſticity, with which electricity may be combined. But M. Haggern, after having obſerved the flaſh from the orange lily, the antheræ of which are a conſiderable ſpace diſtant from the petals, found that the light proceeded from the petals only; whence he concludes, that this electric light is cauſed by the pollen, which, in flying off, is ſcattered on the petals. Whatever be the cauſe, the effect is ſingular and highly curious.

LIGHTS, in painting, are thoſe parts of a piece which are illuminated, or that lie open to the luminary, by which the piece is ſuppoſed to be enlightened; and which, for this reaſon, are painted in bright vivid colours.

In this ſenſe, light is oppoſed to ſhadow.

Different lights have very different effects on a picture, and occaſion a difference in the managment of every part. A great deal therefore depends on the painter's chooſing a proper light for his piece to be illuminated by; and a great deal more, in the conduct of the lights and ſhadows, when the luminary is pitched upon.

The ſtrength and relievo of a figure, as well as its gracefulneſs, depend entirely on the management of the lights, and the joining of thoſe to the ſhadows.

The light a figure receives is either direct or reflected; to each of which ſpecial regard muſt be had. The doctrine of lights and ſhadows makes that part of painting called *chair obſcure.*

LIGHT-*Horſe,* an ancient term in the Engliſh cuſtoms, ſignifying an ordinary cavalier or horſeman lightly armed, and ſo as to enter a corps or regiment; in oppoſition to the men at arms, who were heavily accoutred, and armed at all points. See *Light-Horse.*

LIGHT-*Houſe,* a building erected upon a cape or promontory on the ſea-coaſt, or upon ſome rock in the ſea, and having on its top in the night-time a great fire or light formed by candles, which is conſtantly attended by ſome careful perſon, ſo as to be ſeen at a great diſtance from the land. It is uſed to direct the ſhipping on the coaſt that might otherwiſe run aſhore, or ſteer an improper courſe when the darkneſs of the night and the uncertainty of currents, &c. might render their ſituation with regard to the ſhore extremely doubtful. Lamp-lights are, on many accounts, preferable to coal-fires or candles; and the effect of theſe may be increaſed by placing them either behind glaſs-hemiſpheres, or before properly diſpoſed glaſs or metal reflectors, which laſt method is now very generally adopted. See BEACONS.

LIGHT-*Room,* a ſmall apartment incloſed with glaſs-windows, near the magazine of a ſhip of war. It is uſed to contain the lights by which the gunner and his aſſiſtants are enabled to fill cartridges with powder to be ready for action.

LIGHTER, a large, open, flat-bottomed veſſel, generally managed with oars, and employed to carry goods to or from a ſhip when ſhe is to be laden or delivered.—There are alſo ſome lighters furniſhed with a deck throughout their whole length, in order to contain thoſe merchandiſes which would be damaged by rainy weather: theſe are uſually called *cloſe lighters.*

LIGHTFOOT (John), a moſt learned Engliſh divine, was the ſon of a divine, and born in March 1602, at Stoke upon Trent in Staffordſhire. After having finiſhed his ſtudies at a ſchool on Morton-green near Congleton in Cheſhire, he was removed in 1617 to Cambridge, where he applied himſelf to eloquence, and ſucceeded ſo well in it as to be thought the beſt orator of the under-graduates in the univerſity. He alſo made an extraordinary proficiency in the Latin and Greek; but neglected the Hebrew, and even loſt that knowledge he brought of it from ſchool. His taſte for the oriental languages was not yet excited; and as for logic, the ſtudy of it, as managed at that time among the academics, was too quarrelſome and fierce

fierce for his quiet and meek diſpoſition. As ſoon as he had taken the degree of B. A. he left the univerſity, and became aſſiſtant to a ſchool at Repton in Derbyſhire. After he had ſupplied this place a year or two, he entered into orders, and became curate of Norton under Hales in Shropſhire. This curacy gave an occaſion of awakening his genius for the Hebrew tongue. Norton lies near Bellaport, then the ſeat of Sir Rowland Cotton, who was his conſtant hearer, made him his chaplain, and took him into his houſe. This gentleman being a perfect maſter of the Hebrew language, engaged Lightfoot in that ſtudy; who, by converſing with his patron, ſoon became ſenſible that without that knowledge it was impoſſible to attain an accurate underſtanding of the ſcriptures. He therefore applied himſelf to it with extraordinary vigour, and in a little time made a great progreſs in it; and his patron removing with his family to reſide in London, at the requeſt of Sir Alland Cotton his uncle, who was lord-mayor of that city, he followed his preceptor thither. But he did not ſtay long there: for, having a mind to improve himſelf by travelling abroad, he went down into Staffordſhire to take leave of his father and mother. Paſſing through Stone in that county, he found the place deſtitute of a miniſter: and the preſſing inſtances of the pariſhioners prevailed upon him to undertake that cure. Hereupon, laying aſide his deſign of travelling abroad, he began to turn his thoughts upon ſettling at home. During his reſidence at Bellaport, he had fallen into the acquaintance of a gentlewoman who was the daughter of William Crompton of Stonepark, Eſq; and now, being in poſſeſſion of that living, he married her in 1628. But notwithſtanding this ſettlement, his unquenchable thirſt after rabbinical learning would not ſuffer him to continue there. Sion-college library at London, he knew, was well ſtocked with books of that kind. He therefore quitted his charge at Stone, and removed with his family to Hornſey, near the city; where he gave the public a notable ſpecimen of his advancement in thoſe ſtudies, by his "Erubhim, or Miſcellanies Chriſtian and Judaical," in 1629. He was at this time only 27 years of age; and appears to have been well acquainted with the Latin and the Greek fathers, as well as the ancient heathen writers. Theſe firſt fruits of his ſtudies were dedicated to Sir Rowland Cotton; who, in 1631, preſented him to the rectory of Aſhley in Staffordſhire.

He ſeemed now to be fixed for life: Accordingly, he built a ſtudy in the garden, to be out of the noiſe of the houſe; and applied himſelf with indefatigable diligence in ſearching the ſcriptures. Thus employed, the days paſſed very agreeably; and he continued quiet and unmoleſted, till the great change which happened in the public affairs brought him into a ſhare of the adminiſtration relating to the church; for he was nominated a member of the memorable aſſembly of divines for ſettling a new form of eccleſiaſtical polity. This appointment was purely the effect of his diſtinguiſhed merit; and he accepted it purely with a view to ſerve his country, as far as lay in his power. The non-reſidence, which this would neceſſarily occaſion, apparently induced him to reſign his rectory: and having obtained the preſentation for a younger brother, he ſet out for London in 1642. He had now ſatisfied himſelf in clearing up many of the abſtruſeſt paſſages in the Bible, and therein had provided the chief materials, as well as formed the plan, of his "Harmony;" and an opportunity of inſpecting it at the preſs was, no doubt, an additional motive for his going to the capital; where he had not been long before he was choſen miniſter of St Bartholomew's, behind the Royal Exchange. The aſſembly of divines meeting in 1643, our author gave his attendance diligently there, and made a diſtinguiſhed figure in their debates; where he uſed great freedom, and gave ſignal proofs of his courage as well as learning, in oppoſing many of thoſe tenets which the divines were endeavouring to eſtabliſh. His learning recommended him to the parliament, whoſe viſitors, having ejected Dr William Spurſtow from the maſterſhip of Catharine-hall in Cambridge, put Lightfoot in his room, this year 1653; and he was alſo preſented to the living of Much-Munden in Hertfordſhire, void by the death of Dr Samuel Ward, Margaret-profeſſor of divinity in that univerſity, before the expiration of this year. Meanwhile he had his turn with other favourites in preaching before the houſe of commons, moſt of which ſermons were printed; and in them we ſee him warmly preſſing the ſpeedy ſettlement of the church in the Preſbyterian form, which he cordially believed to be according to the pattern in the Mount. He was all the while employed in preparing and publiſhing the ſeveral branches of his Harmony; all which were ſo many excellent ſpecimens of the uſefulneſs of human learning to true religion: and he met with great difficulties and diſcouragements in that work, chiefly from that antieruditional ſpirit which prevailed, and even threatened the deſtruction of the univerſities. In 1655 he entered upon the office of vice-chancellor of Cambridge, to which he was choſen that year, having taken the degree of doctor of divinity in 1652. He performed all the regular exerciſes for his degree with great applauſe, and executed the vice-chancellor's office with exemplary diligence and fidelity; and particularly at the commencement, ſupplied the place of profeſſor of divinity, then undiſpoſed of as an act which was kept for a doctor's degree in that profeſſion. At the ſame time he was engaged with others in perfecting the Polyglott Bible, then in the preſs. At the reſtoration he offered to reſign the maſterſhip of Catharine-hall: But, as what he had done had been rather in compliance with the neceſſity of the times, than from any zeal or ſpirit of oppoſition to the king and government, a confirmation was granted him from the crown, both of the place and of his living. Soon after this he was appointed one of the aſſiſtants at the conference upon the liturgy, which was held in the beginning of 1661, but attended only once or twice; probably diſguſted at the heat with which that conference was managed. However, he ſtuck cloſe to his deſign of perfecting his Harmony; and being of a ſtrong and healthy conſtitution, which was aſſiſted by an exact temperance, he proſecuted his ſtudies with unabated vigour to the laſt, and continued to publiſh, notwithſtanding the many difficulties he met with from the expence of it. However, not long before he died, ſome bookſellers got a promiſe from him to collect and methodize his works, in order to print them; but the execution was prevented by his death, which happened Dec. 6. 1675. The doctor was twice married; his

firſt

firſt wife, already mentioned, brought him four ſons and two daughters. His ſecond wife was likewiſe a widow, and relict of Mr Auſtin Brogave, uncle of Sir Thomas Brograve, Bart. of Hertfordſhire, a gentleman well verſed in rabbinical learning and a particular acquaintance of our author. He had no iſſue by her. She alſo died before him, and was buried in Munden church; where the doctor was himſelf likewiſe interred near both his wives. Dr Lightfoot's works were collected and publiſhed firſt in 1684, in two volumes folio. The ſecond edition was printed at Amſterdam, in 1686, in two volumes folio, containing all his Latin writings, with a latin tranſlation of thoſe which he wrote in Engliſh. At the end of both theſe editions there is a liſt of ſuch pieces as he left unfiniſhed. It is the chief of theſe, in Latin, which make up the third volume, added to the former two, in a third edition of his works, by John Lueſden, at Utrecht, in 1699, fol. They were communicated by Mr Strype, who, in 1700, publiſhed another collection of theſe papers, under the title of "Some genuine remains of the late pious and learned Dr John Lightfoot.

LIGHTNING, a bright and vivid flaſh of fire, ſuddenly appearing in the atmoſphere, and commonly diſappearing in an inſtant, ſometimes attended with clouds and thunder, and ſometimes not.

1
Different appearances of lightning.

The phenomena of lightning are always ſurpriſing, and ſometimes very terrible; neither is there any kind of natural appearance in which there is more diverſity, not two flaſhes being ever obſerved exactly ſimilar to one another. In a ſerene ſky, the lightning, in this country at leaſt, almoſt always hath a kind of indiſtinct appearance without any determinate form, like the ſudden illumination of the atmoſphere occaſioned by firing a quantity of looſe gunpowder; but when accompanied with thunder, it is well defined, and hath very often a zig-zag form. Sometimes it makes only one angle, like the letter V, ſometimes it hath ſeveral branches, and ſometimes it appears like the arch of a circle. But the moſt formidable and deſtructive form which lightning is ever known to aſſume is that of balls of fire. The motion of theſe is very often eaſily perceptible to the eye; but wherever they fall, much miſchief is occaſioned by their burſting, which they always do with a ſudden exploſion like that of fire-arms. Sometimes they will quietly run along, or reſt for a little upon any thing, and then break into ſeveral pieces, each of which will explode; or the whole ball will burſt at once, and produce its miſchievous effects only in one place. The next to this in its deſtructive effects is the zig-zag kind; for that which appears like indiſtinct flaſhes, whoſe form cannot be readily obſerved, is ſeldom or never known to do hurt.—The colour of the lightning alſo indicates in ſome meaſure its power to do miſchief; the paleſt and brighteſt flaſhes being moſt deſtructive; ſuch as are red, or of a darker colour, commonly doing leſs damage.

2
Its ſeeming omnipreſence.

A very ſurpriſing property of lightening, the zig-zag kind eſpecially when near, is its ſeeming omnipreſence. If two perſons are ſtanding in a room looking different ways, and a loud clap of thunder accompanied with zig-zag lightning happens, they will both diſtinctly ſee the flaſh, not only by that indiſtinct illumination of the atmoſphere which is occaſioned by fire of any kind; but the very form of the lightning itſelf, and every angle it makes in its courſe, will be diſtinctly perceptible, as though they had looked directly at the cloud from whence it proceeded. If a perſon happened at that time to be looking on a book, or other object which he held in his hand, he would diſtinctly ſee the form of the lightning between him and the object at which he looked. This property ſeems peculiar to lightning, and to belong to no other kind of fire whatever.

3
Remarkable effects of lightning.

The effects of lightning are generally confined within a ſmall ſpace; and are ſeldom ſimilar to thoſe which accompany exploſions of gun-powder, or of inflammable air in mines. Inſtances of this kind, however, have occurred; the following is one of the moſt remarkable of which we have any diſtinct account. "Auguſt 2. 1763, about ſix in the evening, there aroſe at Anderlight, about a league from Bruſſels, a conflict of ſeveral winds borne upon a thick fog. This conflict laſted four or five minutes, and was attended with a frightful hiſſing noiſe, which could be compared to nothing but the yellings of an infinite number of wild beaſts. The cloud then opening, diſcovered a kind of very bright lightning, and in an inſtant the roofs of one ſide of the houſes were carried off and diſperſed at a diſtance; above 1000 large trees were broke off, ſome near the ground, others near the top, ſome torn up by the roots; and many both of the branches and tops carried to the diſtance of 60, 100, or 120 paces; whole coppices were laid on one ſide, as corn is by ordinary winds. The glaſs of the windows which were moſt expoſed was ſhivered to pieces. A tent in a gentleman's garden was carried to the diſtance of 4000 paces; and a branch torn from a large tree, ſtruck a girl in the forehead as ſhe was coming into town, at the diſtance of 40 paces from the trunk of the tree, and killed her on the ſpot."

Theſe terrible effects ſeem to have been owing to the prodigious agitation in the air, occaſioned by the emiſſion of ſuch a vaſt quantity of lightning at once; or perhaps to the agitation of the electric fluid itſelf, which is ſtill more dangerous than any concuſſion of the atmoſphere; for thunder-ſtorms will ſometimes produce moſt violent whirlwinds, ſuch as are by the beſt philoſophers attributed to electricity, nay, even occaſion an agitation of the waters of the ocean itſelf; and all this too after the thunder and lightning had ceaſed.—Of this we have the following inſtances. "Great Malvern, October 16. 1761. On Wedneſday laſt, we had the moſt violent thunder ever known in the memory of man. At a quarter paſt four in the afternoon I was ſurpriſed with a moſt ſhocking and diſmal noiſe; 100 forges the neareſt reſemblance I can think of), were they all at work at once, could ſcarce equal it. I ran to the fore-door, and caſting my eye upon the ſide of the hill about 400 yards to the ſouth-weſt of my houſe, there appeared a prodigious ſmoke, attended with the ſame violent noiſe. I ran back into the houſe, aud cried out, a volcano (for ſo I thought) had burſt out of the hill; but I had no ſooner got back again, than I found it had deſcended, and was paſſing on within about 100 yards of the ſouth end of my houſe. It ſeemed to riſe again in the meadow juſt below it; and con-

continued its progreſs to the eaſt, riſing in the ſame manner for four different times, attended with the ſame diſmal noiſe as at firſt; the air being filled with a nauſeous and ſulphureous ſmell. I ſaw it gradually decreaſe till quite extinguiſhed in a turnip-field about a quarter of a mile below my houſe. The turnip leaves, with leaves of trees, dirt, ſticks, &c. filled the air, and flew higher than any of theſe hills. The thunder ceaſed before this happened, and the air ſoon afterwards became calm and ſerene."—The vaſt column of ſmoke mentioned in the above letter was ſo large, that a phyſician of eminence at Worceſter ſaw it in its progreſs down the hill, about a mile from Feckenham, which is above 20 miles from Malvern.—In Auguſt 1763, a moſt violent ſtorm of thunder, rain, and hail, happened at London, which did damage in the adjacent country, to the amount of 50,000 l. Hailſtones fell of an immenſe ſize, from two to ten inches circumference; but the moſt ſurpriſing circumſtance was the ſudden flux and reflux of the tide in Plymouth pool, exactly correſponding with the like agitation in the ſame place, at the time of the great earthquake at Liſbon.

Inſtances are alſo to be found, where lightning, by its own proper force, without any aſſiſtance from thoſe leſs common agitations of the atmoſphere or electric fluid, hath thrown ſtones of immenſe weight to conſiderable diſtances; torn up trees by the root, and broke them in pieces; ſhattered rocks; beat down houſes, and ſet them on fire, &c.

4
Extraordinary effects of lightning on a pyed bullock.

A very ſingular effect of lightning is mentioned in the 66th volume of the Philoſophical Tranſactions, upon a pyed bullock. It happened in the county of Suſſex about the end of Auguſt 1774. The bullock was white and red; and the lightning ſtripped off the white hair leaving the red untouched. The following is a particular account of the matter. "In the evening of Sunday, the 28th of Auguſt, there was an appearance of a thunder-ſtorm, but we heard no report. A gentleman who was riding near the marſhes not far diſtant from this town (Lewes) ſaw two ſtrong flaſhes of lightning, ſeemingly running along the ground of the marſh, at about nine o'clock in the evening. On Monday morning, when the ſervants of Mr Roger, a farmer at Swanborough, in the pariſh of Iford, went into the marſh to fetch the oxen to their work, they found one of them, a four year-old ſteer, ſtanding up to appearance much burnt, and ſo weak as to be ſcarce able to walk. The animal ſeemed to have been ſtruck by lightning in a very extraordinary manner. He is of a white and red colour: the white in large marks, beginning at the rump bone, and running in various directions along both the ſides; the belly is all white, and the whole head and horns white likewiſe. The lightning, with which he muſt have been undoubtedly ſtruck, fell upon the rump bone, which is white, and diſtributed itſelf along the ſides in ſuch a manner as to take off all the hair from the white marks as low as the bottom of the ribs, but ſo as to leave a liſt of white hair, about half an inch broad, all round where it joined to the red, and not a ſingle hair of the red appears to be touched. The whole belly is unhurt, but the end of the ſheath of the penis has the hair taken off; it is alſo taken off from the dewlap: the horns and the curled hair on the forehead are uninjured; but the hair is taken off from the ſides of the face, from the flat part of the jaw-bones, and from the front of the face in ſtripes. There are a few white marks on the ſide and neck, which are ſurrounded with red; and the hair is taken off from them, leaving half an inch of white adjoining to the red. The farmer anointed the ox with oil for a fortnight; the animal purged very much at firſt, and was greatly reduced in fleſh, but is now recovering."

In another account of this accident, the author ſuppoſes that the bullock had been lying down at the time he was ſtruck; which ſhows the reaſon that the under parts were not touched. "The lightning, conducted by the white hair, from the top of the back down the ſides, came to the ground at the place where the white hair was left entire.

The author of this account ſays, that he inquired of a Mr Tooth a farrier, whether he ever knew of a ſimilar accident; and that he told him "the circumſtance was not new to him; that he had ſeen a great many pyed bullocks ſtruck by lightning in the ſame manner as this; that the texture of the ſkin under the white hair was always deſtroyed, though looking fair at firſt; but after a while it became ſore, throwing out a putrid matter in puſtules, like the ſmall-pox with us, which in time falls off, when the hair grows again, and the bullocks receive no farther injury;" which was the caſe with the bullock in queſtion. In a ſubſequent letter, however, the very ſame author informs us, that he had inquired of Mr Tooth "whether he ever ſaw a ſtroke of lightning actually fall upon a pyed bullock, ſo as to deſtroy the white hair, and ſhow evident marks of burning, leaving the red hair uninjured? He ſaid he never did; nor did he recollect any one that had. He gave an account, however, of a pyed *horſe*, belonging to himſelf, which had been ſtruck dead by lightning in the night-time." The exploſion was ſo violent, that Mr Tooth imagined his houſe had been ſtruck, and therefore immediately got up. On going into the ſtable he found the horſe almoſt dead to appearance, though it kept on its legs near half an hour before it expired. The horſe was pyed white on the ſhoulder and greateſt part of the head; *viz.* the forehead and noſe, where the greateſt force of the ſtroke came. "The hair was not burnt nor coloured, only ſo looſened at the root, that it came off with the leaſt touch. And this is the caſe, according to Mr Tooth's obſervation with all that he has ſeen or heard of; *viz.* the hair is never burnt, but the ſkin always affected as abovementioned. In the horſe, all the blood in the veins under the white parts of the head was quite ſtagnated, though he could perceive it to flow in other parts as uſual; and the ſkin, together with one ſide of the tongue, was parched and dried up to a greater degree th n he had ever ſeen before."

5
On a pyed horſe.

Another inſtance is mentioned of this extraordinary effect of lightning upon a bullock, in which even the ſmall red ſpots on the ſides were unaffected; and in this, as well as the former, the white hair on the under part of the belly, and on the legs, was left untouched.

All theſe, however, are to be conſidered as the more unuſual phenomena of lightning; its common mode of action being entirely ſimilar to that of a charged Leyden vial, where the electric matter diſcharges itſelf from a ſubſtance poſitively electrified to one that is negatively ſo. The indentity of electric matter and lightning ſeems now, indeed, ſo well eſtabliſhed, that there is not the leaſt foundation for ſeeking any other ſolution of the phenomena of lightning, than what may be obtained by comparing them with thoſe of our electrical experiments. The different forms of the flaſhes are all exemplified in thoſe of electrical ſparks. Where the quantity of electricity is ſmall, and conſequently incapable of ſtriking at any conſiderable diſtance, the ſpark appears ſtraight, without any curvature, or angular appearance; but where the electricity is very ſtrong, and of conſequence capable of ſtriking an object at a pretty conſiderable diſtance, it aſſumes a crooked or zig-zag form. This is always the caſe with Mr Nairn's very powerful machines, the conductors of which are ſix feet in length and one foot in diameter. Sparks may be taken from them at the diſtance of 16, 17, or even 20 inches; and all of theſe put on the angular zig-zag form of lightning. The reaſon of this appearance, both in theſe ſparks and in the lightning, is, that the more fluid electric matter hath to paſs through the denſer and leſs fluid atmoſphere with great rapidity; and in fact, this is the way in which all the more fluid ſubſtances paſs through thoſe that are leſs ſo, at leaſt when their velocity becomes conſiderable. If bubbles of air or ſteam paſs very gently up through water, their courſe from the bottom to the top of the veſſel will differ very little, if at all, from a ſtraight line; but when they are impelled by a conſiderable force, as in air blown from a bellows, or the bubbles of ſteam which ariſe in boiling water, their courſe is then marked by waved and crooked lines, and the deflection of the bubbles to the right or left will he preciſely in proportion to their aſcending velocity, and to the weight of the water by which they are reſiſted.

6
Similarity between electric ſparks and lightning.

7
Why it aſſumes a zig-zag form.

In the caſe of air blown through water, however, or ſteam aſcending from the bottom of a veſſel of boiling water, though the courſe of the bubbles is waved and crooked, we never obſerve it to be angular as in lightning. The reaſon of this is, that there is no proportion between the capacity of the air for yielding to the impetus of lightning, and the velocity with which the latter is moved. From Mr Robins's experiments in gunnery, it appears, that the air cannot yield with a velocity much greater than 1200 feet in a ſecond, and that all projectiles moving with a greater degree of velocity meet with a violent reſiſtance. But if we ſuppoſe lightning to move only with one half the velocity of light, that is, near 100,000 miles in a ſecond, or even with that of 1000 miles in a minute, which moſt probably is the caſe*, its motion in the fluid atmoſphere will meet with a reſiſtance very little inferior to what air would meet with in paſſing through the moſt ſolid bodies. The ſmalleſt difference of the reſiſtance of the atmoſphere on either ſide, muſt determine the lightning to that ſide: and in its paſſage to that new place, where the reſiſtance is leaſt, it muſt paſs on in a ſtraight line, making an angle with its former courſe, becauſe the atmoſphere is altogether incapable of yielding with ſuch rapidity as the electric matter requires, and therefore reſiſts like a ſolid rock. The caſe is otherwiſe in the former examples: for tho' a ſmall difference in the reſiſtance forces the bubbles of air or ſteam to deviate from ſide to ſide, yet there is always a conſiderable proportion between the capacity of water for yielding, and that force by which the bubbles urge it to yield; ſo that though it does make a reſiſtance ſufficient to prevent the bubbles from moving in a ſtraight line, yet it alſo perceptibly yields in all times, and therefore the tract of the bubbles is formed by a number of curves and not angles.

8
Why ſuch kind of lightning is very dangerous.

Hence we may underſtand the reaſon why the zig-zag kind of lightning is ſo dangerous, namely, becauſe it muſt overcome a very violent reſiſtance of the atmoſphere; and wherever that reſiſtance is in the ſmalleſt degree leſſened, there it will undoubtedly ſtrike and at a very conſiderable diſtance too. It is otherwiſe with that kind which appears in flaſhes of no determinate form. The electric matter of which theſe are compoſed, is evidently diſſipated in the air by ſome conducting ſubſtances which are preſent there; and of conſequence, though a man, or other conducting body, happened to be very near ſuch a flaſh, he would not be ſtruck or materially injured by it, though a zig-zag flaſh, in ſuch circumſtances, would have probably diſcharged its whole force upon him.

9
Why lightning aſſumes the form of balls.

The moſt deſtructive kind of lightning, however, as we have already obſerved, is that which aſſumes the form of balls. Theſe are produced by an exceedingly great power of electricity gradually accumulated till the reſiſtance of the atmoſphere is no longer able to confine it. In general, the lightning breaks out from the electrified cloud by means of the approach of ſome conducting ſubſtance, either a cloud, or ſome terreſtrial ſubſtance: but the fire-balls ſeem to be formed, not becauſe there is any ſubſtance at hand to attract the electric matter from the cloud, but becauſe the electricity is accumulated in ſuch quantity that the cloud itſelf can no longer contain it. Hence ſuch balls fly off ſlowly, and have no particular deſtination. Their appearance indicates a prodigious commotion and accumulation of electricity in the atmoſphere, without a proportionable diſpoſition in the earth to receive it. This diſpoſition, however, we know, is perpetually altered by a thouſand circumſtances, and the place which firſt becomes moſt capable of admitting electricity will certainly receive a fire-ball. Hence this kind of lightning has been known to move ſlowly backwards and forwards in the air for a conſiderable ſpace of time, and then ſuddenly to fall on one or more houſes, according to their being more or leſs affected with an electricity oppoſite to that of the ball at the time. It will alſo run along the ground, break into ſeveral parts, and produce ſeveral exploſions at the ſame time.

It is very difficult to imitate lightning of this kind in our electrical experiments. The only caſes in which it hath been done in any degree are thoſe in which Dr Prieſtley made the exploſion of a battery paſs for a conſiderable way over the ſurface of raw fleſh, water, &c. and in Mr Arden's experiment, when a fire-ball aſcended to the top of an electrified jar, and burſt it with a violent exploſion. See Electricity n° 89, &c. In theſe caſes, if, while the electric flaſh paſſed over the ſurface of the fleſh, it had been poſſible to interrupt the metallic circuit by taking away the chain, the electric matter diſcharged from the battery would have been preciſely in the ſituation of one of the fire-balls

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* See *Fire-ball*.

balls abovementioned; *i. e.* it would have been at a loſs for a conductor. The negative ſide of the battery was the place of its deſtination; but to that it would not have eaſily got, becauſe of the great quantity of atmoſphere which lay in its way, and the incapacity of the neighbouring bodies to receive it. But, while the electric matter was thus ſtationary for want of a conductor, if any perſon ſtanding near, or touching the negative ſide of the battery, preſented a finger to that ſeemingly inoffenſive luminous body, he would inſtantly be ſtruck very violently; and becauſe a free communication being now made by means of his body, the powers by which the electric fluid is impelled from one place to another would inſtantly urge it upon him. But if we ſuppoſe a perſon, who hath no communication with the battery, to preſent his finger to the ſame body, he may perhaps receive a ſlight ſpark from it; but not a ſhock of any conſequence, becauſe there is not a perfect communication by means of his body with the place to which the electric fire is deſtined.

10
Phenomena of lightning in general accounted for.

Hence we may account for the ſeemingly capricious nature of lightning of all kinds, but eſpecially of that kind which appears in the form of balls. Sometimes it will ſtrike trees, high houſes, ſteeples, and towers, without touching cottages, men, or other animals, who are in the neighbourhood. In ſuch caſes, people would be apt to ſay that the neighbourhood of theſe higher objects *preſerved* the others from the ſtroke; but with little reaſon, ſince low houſes, men walking in the fields, cattle, nay the ſurface of the earth itſelf, have all been ſtruck, while high trees and ſteeples in the neighbourhood have not been touched. In like manner, fire-balls have paſſed very near certain perſons without hurting them, while they have, as it were, gone conſiderably out of their way to kill others. The reaſon of all this is, that in thunder-ſtorms there is conſtantly a certain zone of earth conſiderably under the ſurface, which the lightning deſires (if we may uſe the expreſſion) to ſtrike, becauſe it hath an electricity oppoſite to that of the lightning itſelf. Thoſe objects, therefore, which form the moſt perfect conductors between the electrified clouds and that zone of earth, will be ſtruck by the lightning, whether they are high or low; and becauſe we know not the conducting quality of the different terreſtrial ſubſtances, the ſuperſtitious are apt to aſcribe ſtrokes of lightning to the divine vengeance againſt particular perſons, whereas it is certain that this fluid, as well as others, acts according to invariable rules from which it is never known to depart.

Lightning, in the time of ſevere thunder-ſtorms, is ſuppoſed to proceed from the earth, as well as from the clouds: but this fact hath never been well aſcertained, and indeed from the nature of the thing it ſeems very difficult to be aſcertained; for the motion of the electric fluid is ſo very quick, that it is altogether impoſſible to determine, by means of our ſenſes, whether it goes from the earth or comes to it. In fact, there are in this country many thunder-ſtorms in which it doth not appear that the lightning touches any part of the earth, and conſequently can neither go to it or come out from it. In theſe caſes, it flaſhes either from an electrified cloud to one endowed with an oppoſite electricity, or merely into thoſe parts of the atmoſphere which are ready to receive it. But if not only the clouds, but the atmoſphere all the way betwixt them and the earth, and likewiſe for a conſiderable ſpace above the clouds, are electrified one way, the earth muſt then be ſtruck. The reaſon of this will appear from a conſideration of the principles laid down under the article ELECTRICITY, ſect. vi. It there appears, that the electric fluid is altogether incapable either of *accumulation* or *diminution* in quantity in any particular part of ſpace. What we call *electricity* is only the motion of this fluid made perceptible to our ſenſes. Poſitive electricity is when the current of electric matter is directed from the electrified body. Negative electricity is when the current is directed towards it. Let us now ſuppoſe, that a poſitively electrified cloud is formed over a certain part of the earth's ſurface. The electric matter flows out from it firſt into the atmoſphere all round; and while it is doing ſo, the atmoſphere is negatively electrified. In proportion, however, as the electric current pervades greater and greater proportions of the atmoſpherical ſpace, the greater is the reſiſtance to its motion, till at laſt the air becomes poſitively electrified as well as the cloud, and then both act together as one body. The ſurface of the earth then begins to be affected, and it ſilently receives the electric matter by means of the trees, graſs, &c. till at laſt it becomes poſitively electrified alſo, and begins to ſend of a current of electricity from the ſurface downwards. The cauſes which at firſt produced the electricity of the clouds (and which are treated of under the article THUNDER), ſtill continuing to act, the power of the electric current becomes inconceivably great. The danger of the thunder-ſtorm now begins; for as the force of the lightning is directed to ſome place below the ſurface of the earth, it will certainly dart towards that place, and ſhatter every thing to pieces which reſiſts its paſſage. The benefit of conducting-rods will now alſo be evident: for we are ſure that the electric matter will in all caſes take the way where it meets with the leaſt reſiſtance; and this is through the ſubſtance, or rather over the ſurface, of metals. In ſuch a caſe therefore, if there happen to be a houſe furniſhed with a conductor directly below the cloud, and at the ſame time a zone of negatively electrified earth not very far below the foundation of the houſe, the conductor will almoſt certainly be ſtruck, but the building will be unhurt. If the houſe wants a conductor, the lightning will nevertheleſs ſtrike in the ſame place, in order to get at the negatively electrified zone abovementioned; but the building will now be damaged, becauſe the materials of it cannot readily conduct the electric fluid.

11
Uſe of conducting rods.

12
Whether knobbed or pointed conductors are preferable

We will now be able to enter into the diſpute, Whether the preference is due to knobbed or pointed conductors for preſerving buildings from ſtrokes of lightning? Ever ſince the diſcovery of the identity of electricity and lightning, it hath been allowed by all parties, that conductors of ſome kind are in a manner eſſentially neceſſary for the ſafety of buildings in thoſe countries where thunder-ſtorms are very frequent. The principle on which they act hath been already explained; namely, that the electric fluid, when impelled by any power, always goes to that place where it meets with the leaſt reſiſtance, as all other fluids alſo do. As metals, therefore, are found to give the leaſt reſiſtance to its paſſage, it will always chooſe to run along a metalline rod, in preference to a paſſage of any other kind. We muſt, however, carefully conſider a circumſtance which ſeems to have been too much overlooked by electricians in their reaſonings concerning the effects of thunder-rods; namely, That lightning or electricity, never ſtrikes a body, merely for the ſake of the body itſelf, but only becauſe by means of that body it can readily arrive at the place of its deſtination. When a quantity of electricity is collected from the earth, by means of an electric machine, a body communicating with the earth, will receive a ſtrong ſpark from the prime conductor. The body receives this ſpark, not becauſe it is itſelf capable of containing all the electricity of the conductor and cylinder, but becauſe the natural ſituation of the fluid being diſturbed by the motion of the machine, a ſtream of it is ſent off from the earth. The natural powers, therefore, make an effort to ſupply what is thus drained off from the earth; and as the individual quantity which comes out is moſt proper for ſupplying the deficiency, as not being employed in any natural purpoſe, there is always an effort made for returning it to the earth. No ſooner, then, is a conducting body, communicating with the earth, preſented to the electrical machine, than the whole effort of the electricity is directed againſt that body, not merely becauſe it is a conductor, but becauſe it leads to the place where the fluid is directed by the natural powers by which it is governed, and at which it would find other means to arrive, though that body were not to be preſented. That this is the caſe, we may very eaſily ſatisfy ourſelves, by preſenting the very ſame conducting ſubſtance in an inſulated ſtate to the prime conductor of the machine; for then we ſhall find, that only a very ſmall ſpark will be produced. In like manner, when lightning ſtrikes a tree, a houſe, or a thunder rod, it is not becauſe theſe objects are high, or in the neighbourhood of the cloud; but becauſe they communicate with ſome place below the ſurface of the ground, againſt which the impetus of the lightning is directed; and at that place the lightning would certainly arrive, though none of the abovementioned objects had been interpoſed.

The fallacy of that kind of reaſoning generally employed concerning the uſe of thunder-rods, will now be ſufficiently apparent. Becauſe a point preſented to an electrified body in our experiments, always draws off the electricity in a ſilent manner; therefore Dr Franklin and his followers have concluded, that a pointed conductor will do the ſame thing to a thunder-cloud, and thus effectually prevent any kind of danger from a ſtroke of lightning. Their reaſoning on this ſubject, they think, is confirmed by the following fact among many others. "Dr Franklin's houſe at Philadelphia was furniſhed with a rod extending nine feet above the top of the chimney. To this rod was connected a wire of the thickneſs of a gooſe-quill, which deſcended through the wall of the ſtair-caſe; where an interruption was made, ſo that the ends of the wire, to each of which a little bell was fixed, were diſtant from each other about ſix inches; an inſulated braſs ball hanging between the two bells. The author was one night waked by loud cracks, proceeding from his apparatus in the ſtair-caſe. He perceived, that the braſs ball, inſtead of vibrating as uſual between the bells, was repelled and kept at a diſtance from both; while the fire ſometimes paſſed in very large quick cracks directly from bell to bell; and ſometimes in a continued denſe white ſtream, ſeemingly as large as his finger; by means of which the whole ſtair caſe was enlightened, as with ſun-ſhine, ſo that he could ſee to pick up a pin. From the apparent quantity of electric matter of which the cloud was thus evidently robbed, by means of the pointed rod (and of which a blunt conductor would not have deprived it), the author conceives, that a number of ſuch conductors muſt conſiderably leſſen the quantity of electric fluid contained in any approaching cloud, before it comes ſo near as to deliver its contents in a general ſtroke."

For this very reaſon, Mr Benjamin Wilſon and his followers, who conſtitute the oppoſite party, have determined that the uſe of pointed conductors is utterly unſafe. They ſay, that in violent thunder ſtorms the whole atmoſphere is full of electricity; and that attempts to exhauſt the vaſt quantity there collected, are like attempting to clear away an inundation with a ſhovel, or to exhauſt the atmoſphere with a pair of bellows. They maintain, that though pointed bodies will effectually prevent the accumulation of electricity in any ſubſtance; yet if a non-electrified body is interpoſed between a point and the conductor of an electrical machine, the point will be ſtruck at the ſame moment with the non-electrified body, and at a much greater diſtance than that at which a knob would be ſtruck. They affirm alſo, that by means of this ſilent ſolicitation of the lightning, inflammable bodies, ſuch as gun-powder, tinder, and Kunckel's phoſphorus, may be ſet on fire; and for theſe laſt facts they bring deciſive experiments. From all this, ſay they, it is evident that the uſe of pointed conductors is unſafe. They ſolicit a diſcharge to the place where they are; and as they are unable to conduct the whole electricity in the atmoſphere, it is impoſſible for us to know whether the diſcharge they ſolicit may not be too great for our conductor to bear; and conſequently all the miſchiefs ariſing from thunder-ſtorms may be expected, with this additional and mortifying circumſtance, that this very conductor hath probably ſolicited the fatal ſtroke, when without it the cloud might have paſſed harmleſs over our heads without ſtriking at all.

Here the reaſoning of both parties ſeems equally wrong. They both proceed on this erroneous principle, That in thunder-ſtorms the conductor will always ſolicit a diſcharge, or that at ſuch times all the elevated objects on the ſurface of the earth are drawing off the electricity of the atmoſphere. But this cannot be the caſe, unleſs the electricity of the earth and of the atmoſphere is of a different kind. Now, it is demonſtrable, that until this difference between the electricity of the atmoſphere and of the ſurface of the earth ceaſes, there cannot be a thunder-ſtorm. When the atmoſphere begins to be electrified either poſitively or negatively, the earth, by means of the ineqalities and moiſture of its ſurface, but eſpecially by the vegetables which grow upon it, abſorbs that electricity, and quickly becomes electrified in the ſame manner with the atmoſphere. This abſorption, however, ceaſes in a very ſhort time, becauſe it cannot be continued without ſetting in motion the whole of the electric matter contained in the earth itſelf. Alternate zones of poſitive and negative electricity will then begin to take place below the ſurface of the earth, for the reaſons mentioned under the article Electricity, ſect. vi. § 9. Between the atmoſphere and one of theſe zones, the ſtroke of the lightning always will be. Thus ſuppoſing the atmoſphere is poſitively electrified, the ſurface of the earth will, by means of trees, &c. quickly become poſitively electrified alſo; we ſhall ſuppoſe to the depth of 10 feet. The electricity cannot penetrate farther on account of the reſiſtance of the electric matter in the bowels of the earth. At the depth of 10 feet from the ſurface, therefore, a zone of negatively electrified earth begins, and to this zone the electricity of the atmoſphere is attracted; but to this it cannot get, without breaking through the poſitively electrified zone which lies uppermoſt, and ſhattering to pieces every bad conductor which comes in its way. We are very ſure, therefore, that in whatever places the outer-zone of poſitively electrified earth is thinneſt there the lightning will ſtrike, whether a conductor happens to be preſent or not. If there is a conductor, either knobbed or ſharp-pointed, the lightning will indeed infallibly ſtrike it; but it would alſo have ſtruck a houſe ſituated on that ſpot, without any conductor; and though the houſe had not been there, it would have ſtruck the ſurface of the ground itſelf.—Again, if we ſuppoſe the houſe with its conductor to ſtand on a part of the ground where the poſitively electrified zone is very thick the conductor will neither ſilently draw off the electricity, nor will the lightning ſtrike it, though perhaps it may ſtrike a much lower object, or even the ſurface of the ground itſelf, at no great diſtance; the reaſon of which undoubtedly is, that there the zone of poſitively electrified earth is thinner than where the conductor was.

We muſt alſo obſerve, that the Franklinians make their pointed conductors to be of too great conſequence. To the houſes on which they are fixed, no doubt, their importance is very great: but in exhauſting a thunder-cloud of its electricity, their uſe muſt appear trifling; and to inſiſt on it, ridiculous. Innumerable objects, as trees, graſs, &c. are all conſpiring to draw off the electricity, as well as the conductor, if it could be drawn off; but of effecting this there is an impoſſibility, becauſe they have the ſame kind of electricity with the clouds themſelves. The conductor hath not even the power of *attracting* the lightning a few feet out of the direction which it would chooſe of itſelf. Of this we have a moſt remarkable and deciſive inſtance in what happened to the magazine at Purfleet in Eſſex, on May 15. 1777. That houſe was furniſhed with a pointed conductor, raiſed above the higheſt part of the building; nevertheleſs, about ſix in the evening of the abovementioned day, a flaſh of lightning ſtruck an iron cramp in the corner of the wall conſiderably lower than the top of the conductor, and only 46 feet in a ſloping line diſtant from the point.—This produced a long diſpute with Mr Wilſon concerning the propriety of uſing pointed conductors; and, by the favour of his majeſty, he was enabled to conſtruct a more magnificent electrical apparatus than any private perſon could be ſuppoſed to erect at his own expence, and of which ſome account is given under the article Electricity, nº 83. The only new experiments, however, which this apparatus produced, were the firing of gunpowder by the electric *aura* as it is called; and a particularly violent ſhock which a perſon received when he held a ſmall pointed wire in his hand, upon which the conductor was diſcharged. We muſt obſerve, that the electrified ſurface of the conductor was 620 feet; and we can have but little idea of the ſtrength of ſparks from a conductor of this magnitude, ſuppoſing it properly electrified. Six turns of the wheel made the diſcharge felt through the whole body like the ſtrong ſhock of a Leyden vial; and nobody choſe to make the experiment when the conductor had received a higher charge. A very ſtrong ſhock was felt as already obſerved, when this conductor was diſcharged upon a pointed wire held in a perſon's hand, even though the wire communicated with the earth; which was not felt, or but very little, when a knobbed wire was made uſe of. To account for this difference may, perhaps, puzzle electricians; but with regard to the uſe of blunt or pointed thunder-rods, both experiments ſeem quite inconcluſive. Though a very great quantity of electric matter ſilently drawn off will fire gunpowder, this only proves that a pointed conductor ought not to paſs through a barrel of gunpowder; and if a perſon holding a pointed wire in his hand received a ſtrong ſhock from Mr Wilſon's great conductor, it can thence only be inferred, that in the time of thunder nobody ought to hold the conductor in their hands; both which precautions common ſenſe would dictate without any experiment. From the accident at Purfleet, however the diſputants on both ſides ought to have ſeen, that, with regard to lightning, neither points or knobs can *attract*. Mr Wilſon ſurely had no reaſon to condemn the pointed conductor for *ſoliciting* the flaſh of lightning, ſeeing it did not ſtrike the point of the conductor, but a blunt cramp of iron; neither have the Franklinians any reaſon to boaſt of its effect in *ſilently drawing off* the electric matter, ſince all its powers were neither able to prevent the flaſh, nor to turn it 46 feet out of its way. The matter of fact is, the lightning was determined to enter the earth at the place where the board-houſe ſtands, or near it. The conductor fixed on the houſe offered the eaſieſt communication: but 46 feet of air intervening between the point of the conductor and the place of exploſion, the reſiſtance was leſs through the blunt cramp of iron, and a few bricks moiſtened with rain-water, to the ſide of the metalline conductor, than through the 46 feet of air to its point; for the former was the way in which the lightning actually paſſed.

Mr Wilſon and his followers ſeem alſo miſtaken in ſuppoſing that a pointed conductor can ſolicit a greater diſcharge than what would otherwiſe happen. Allowing the quantity of electricity in the atmoſphere during the time of a thunder-ſtorm to be as great as they pleaſe to ſuppoſe; nevertheleſs, it is impoſſible that the air can part with all its electricity at once, on account of the difficulty with which the fluid moves in it. A pointed conductor, therefore, if it does any thing at all, can only ſolicit the partial diſcharge which is to be made at any rate : and if none were to be made though the conductor was abſent, its preſence will not be able to effect any.

An objection to the uſe of conductors, whether blunt or pointed, may be drawn from the accident which happened to the poor-houſe at Heckingham, which was ſtruck by lightning though furniſhed with eight pointed conductors ; but from an accurate conſideration of the manner in which the conductors were ſituated, it appears that there was not a poſſibility of their preventing any ſtroke. See Philoſophical Tranſactions. Vol. LXXII. p. 361.

13
Lord Mahon's theory of lightning.

In a late publication on the ſubject of electricity by Lord Mahon, we find a new kind of lightning made mention of, which he is of opinion may give a fatal ſtroke, even though the main exploſion be at a conſiderable diſtance ; a mile, for inſtance, or more. This he calls *the electrical returning ſtroke* ; and exemplifies it in the following manner, from ſome experiments made with a very powerful electrical machine, the prime conductor of which (ſix feet long, by one foot diameter) would generally, when the weather was favourable, ſtrike into a braſs ball connected with the earth, to the diſtance of 18 inches or more. In the following account, this braſs ball, which we ſhall call *A*, is ſuppoſed to be conſtantly placed at the *ſtriking diſtance* ; ſo that the prime conductor, the inſtant that it becomes fully charged, explodes into it.

Another large conductor, which we ſhall call the *ſecond conductor*, is ſuſpended, in a perfectly inſulated ſtate, farther from the prime conductor than the *ſtriking diſtance*, but within its *electrical atmoſphere* ; at the diſtance of *ſix feet*, for inſtance. A perſon ſtanding on an inſulating ſtool touches this *ſecond conductor* very lightly with a finger of his right hand ; while, with a finger of his left hand, he communicates with the earth, by touching very lightly a ſecond braſs ball fixed at the top of a metallic ſtand, on the floor, and which we ſhall call *B*.

While the prime conductor is receiving its electricity, ſparks paſs (at leaſt if the diſtance between the two conductors is not too great from the ſecond conductor *to* the inſulated perſon's right hand ; while ſimilar and ſimultaneous ſparks paſs out *from* the finger of his left hand into the ſecond metallic ball *B*, communicating with the earth. Theſe ſparks are part of the *natural quantity* of electric matter belonging to the ſecond conductor, and to the inſulated perſon ; driven from them into the earth, through the ball *B*, and its ſtand by the elaſtic preſſure or action of the electrical atmoſphere of the prime conductor. The ſecond conductor and the inſulated perſon are hereby reduced to a *negative* ſtate.

At length, however, the prime conductor, having acquired its *full charge*, ſuddenly ſtrikes into the ball *A*, of the firſt metallic ſtand, placed for that purpoſe at the *ſtriking diſtance* of 17 or 18 inches. The exploſion being made, and the prime conductor ſuddenly robbed of its electric atmoſphere, its preſſure or action on the ſecond conductor, and on the inſulated perſon, as ſuddenly ceaſes ; and the later inſtantly feels a ſmart *returning ſtroke*, though he has no direct or viſible communication (except by the floor) either with the *ſtriking* or *ſtruck* body, and is placed at the diſtance of *five* or *ſix feet* from both of them. This returning ſtroke is evidently occaſioned by the ſudden *re-entrance* of the electric fire *naturally* belonging to his body and to the ſecond conductor, which had before been expelled from them by the action of the charged prime conductor upon them ; and which returns to its former place the inſtant that action or elaſtic preſſure ceaſes. The author ſhows, that there can be no reaſon to ſuppoſe that the electrical diſcharge from the prime conductor ſhould in this experiment *divide itſelf* at the inſtant of the exploſion, and go different ways, ſo as to ſtrike the ſecond conductor and inſulated perſon in this manner, and at ſuch a diſtance from it.

When the ſecond conductor and the inſulated perſon are placed in the *denſeſt* part of the electrical atmoſphere of the prime conductor, or *juſt beyond* the ſtriking diſtance, the effects are ſtill more conſiderable ; the *returning ſtroke* being extremely ſevere and pungent, and appearing conſiderably ſharper than even the *main ſtroke* itſelf, received directly from the prime conductor. This circumſtance the author alleges as an unanſwerable proof that the effect which he calls the *returning ſtroke*, was not produced by the *main ſtroke* being any wiſe *divided* at the time of the exploſion, ſince no *effect* can ever be greater than the *cauſe* by which it is *immediately* produced.—Having taken the *returning ſtroke* eight or ten times one morning, he felt a conſiderable degree of pain acroſs his cheſt during the whole evening, and a diſagreeable ſenſation in his arms and wriſts all the next day.

We come now to the application of this experiment, and of the doctrine deduced from it, to what paſſes in *natural electricity*, or during a thunder-ſtorm ; in which there is reaſon to expect ſimilar effects, but on a larger ſcale :—a ſcale ſo large indeed, according to the author's repreſentation, that perſons and animals may be deſtroyed, and particular parts of buildings may be conſiderably damaged, by an electrical *returning ſtroke*, occaſioned even by ſome *very diſtant exploſion* from a thunder-cloud :—poſſibly at the diſtance of a mile or more.

It is certainly eaſy to conceive, that a charged extenſive thunder-cloud muſt be productive of effects ſimilar to thoſe produced by the author's prime conductor. Like it, while it continues charged, it will, by *the ſuperinduced elaſtic electrical preſſure* of its atmoſphere, to uſe the author's own expreſſion, drive into the earth a part of the electric fluid *naturally* belonging to the bodies which are within the reach of its *widely extended* atmoſphere ; and which will therefore become *negatively* electrical. This portion too of their electric fire, as in the artificial experiments, will, on the exploſion of the cloud, *at a diſtance*, and the ceſſation of its action upon them, ſuddenly *return* to them ; ſo as to produce an equilibrium, and reſtore them to their *natural* ſtate.

14
Anſwered by the Reviewers.

To this theory, the authors of the Monthly Review have given the following anſwer : "We cannot, however, agree with the ingenious author, with reſpect to the *greatneſs* of the effects, or of the danger to be apprehended from the *returning ſtroke* in this caſe ; as we think his eſtimate is grounded on an erroneous foundation.—'Since (ſays he) the denſity of the electrical atmoſphere of a *thunder-cloud* is ſo *immenſe*, when compared to the electrical denſity of the electrical atmoſphere of any *prime conductor*, charged by means of any electrical apparatus whatſoever; and ſince a *returning ſtroke,* when produced by the *ſudden* removal of even the *weak* elaſtic electrical preſſure of the electrical atmoſphere of a charged *prime conductor,* may be extremely *ſtrong,* as we have ſeen above; it is *mathematically evident,* that, when a *returning ſtroke* comes to be produced by the *ſudden* removal of the very ſtrong elaſtic electrical preſſure of the electrical atmoſphere of a thunder-cloud powerfully charged; the ſtrength of ſuch a *returning ſtroke* muſt be enormous.'

" If indeed the quantity of electric fluid *naturally* contained in the body of a man, for inſtance, were immenſe, or indefinite, the author's eſtimate between the effects producible by a cloud, and thoſe cauſed by a prime conductor, might be admitted. But ſurely an electrified cloud,—how great ſoever may be its extent, and the height of its charge when compared with the extent and charge of a prime conductor—cannot expel from a man's body (or any other body), *more* than the *natural* quantity of electricity which it contains. On the ſudden removal, therefore, of the preſſure by which this natural quantity had been expelled, in conſequence of the exploſion of the cloud into the earth; *no more* (at the utmoſt) than his *whole natural ſtock* of electricity can re-enter his body (C). But we have no reaſon to ſuppoſe that this quantity is ſo great, as that its ſudden re-entrance into his body ſhould deſtroy or even injure him.

" In the experiment above deſcribed, the inſulated perſon receives into his body, at the inſtant of the *returning ſtroke,* not only all that portion of his own natural electric fire which had been expelled from it; but likewiſe tranſmits through it, at the ſame inſtant, *in conſequence of his peculiar ſituation,* all the electric fire of which the large ſecond conductor had been robbed; and which muſt neceſſarily *re*-paſs through his body to arrive at that conductor. To render the caſe ſomewhat parallel, in *natural electricity,* the man's body muſt be ſo peculiarly circumſtanced, ſuppoſing him to be in a houſe, that the electric matter which has been expelled from the houſe into the earth, by the preſſure of an extenſive thunder-cloud, could not return back into the building, on the exploſion of the cloud at a diſtance, without paſſing through his body: a caſe not likely to happen, unleſs the houſe were inſulated (like the ſecond conductor in the preceding experiment), and his body became the channel through which alone the houſe could have its electric matter reſtored to it; it appears much more probable that the electric matter returns to the houſe through the *ſame channels* by which it before inſenſibly paſſed out, and with equal ſilence, though more ſuddenly.

" In the caſe of a man who is abroad, and in an open field, during the time of an exploſion:—as he is unconnected with other maſſes of matter *above him,* no more than the preciſe quantity of electric fire, which had been before expelled from his body, will *ſuddenly* return into it at the inſtant of a diſtant exploſion: and that this quantity is not uſually very large, may be inferred from many conſiderations.

" When a perſon ſtanding on the ground holds a pair of Mr Canton's balls in his hand, while a highly charged thunder-cloud is ſuſpended over his head; the angle made by the balls indicates the *electrical ſtate* of that perſon, or the quantity of *natural* electricity of which his body is at that time deprived, by the action of the (*poſitively*) charged cloud hanging over him. But we have never ſeen the repulſion of the balls ſo conſiderable, as to furniſh any juſt apprehenſions that the return of his natural electric matter, however ſudden, could be attended with injury to him: nor would he be ſenſible of any commotion on the balls ſuddenly coming together; though a ſpark might undoubtedly be perceived, at that inſtant, were he inſulated, and placed in the ſame manner with the author when he tried the above-related experiment.

" The author nevertheleſs obſerves, that 'there have been inſtances of perſons who have been killed by *natural* electricity having been found with their *ſhoes torn,* and with their *feet* damaged by the electrical fire; but who have not had, over their whole body, any other apparent marks of having been ſtruck with lightning.' He adds, 'if a man walking out of doors were to be killed by a *returning ſtroke,* the electrical fire would ruſh into that man's body through his *feet,* and his feet only; which would *not* be the caſe, were he to be killed by any *main ſtroke* of exploſion, either poſitive or negative.'

" It would be no difficult taſk, we think, to account for theſe appearances in a different manner; were all the circumſtances attending the caſe minutely aſcertained: but without interrogating the *dead* on this ſubject, we may more ſatisfactorily appeal to the experience of the *living* (D), to ſhow, that though the *returning ſtroke* muſt take place, in all thunder-ſtorms, *in ſome degree or other;* yet it is not of that alarming magnitude which the author aſcribes to it. If, in any particular thunder-ſtorm, a man in the open fields could be killed, at the inſtant of a diſtant exploſion, merely by the *return* of his *own* electric fire, which had before been driven out of his body; ſurely numerous obſervations of perſons who had experienced the *returning ſtroke,* in *ſlighter* degrees, would be familiar; and ſcarce a great thunder-ſtorm muſt have occurred, in which one

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(C) " We ſuppoſe the perſon not to be ſo ſituated, that the *returning fire* of other bodies muſt neceſſarily paſs through his body."

(D) " The author does indeed produce a *living* evidence, in the caſe of a perſon at Vienna, who, he has been credibly informed, received an electrical ſhock, by having held one hand accidentally in contact with an *interrupted* metallic conducting rod, at the inſtant that a thunder-cloud exploded at the diſtance, as was conjectured, of above half an Engliſh mile. He likewiſe obſerves, that a 'very ſtrong, bright, and ſudden *ſtroke*' (or ſpark) of electrical fire has been ſeen, by ſeveral electricians, to paſs in the interval, or interruption, purpoſely left in the conducting rod of a houſe at the inſtant of a diſtant exploſion; and 'when it was fully proved, by the ſharp point of the conductor not being melted, or even tinged,' that the conductor itſelf had not been ſtruck.—Theſe obſervations, however, do not by any means prove the *magnitude* or *danger* of the returning ſtroke, but merely its *exiſtence;* which we do not conteſt."

one perſon or another muſt not, at the inſtant of an exploſion, have felt the effects of the *returning ſtroke* in *ſome degree or other*—from that of a violent *concuſſion*, to that of a ſlight and almoſt imperceptible *pulſation*. But no obſervations of this kind are known to us, nor have we ever heard of any perſon's experiencing any kind of electrical commotion in a thunder-ſtorm, except ſuch as have either been directly ſtruck, or have happened to be in the *very near neighbourhood* of the ſpot where the exploſion took place.

“ The author has been aware of this objection, which he propoſes, and endeavours to remove; but his anſwer to it amounts to little more than what has been already quoted from him ; that is, to a ſimple eſtimate of the enormous difference between the electrical denſity or the *elaſtic electrical preſſure*, of the atmoſphere of an extenſive *thunder cloud*, and that of a charged *prime conductor*. We have already obſerved, that this is not a proper method of eſtimating their different effects, when theſe two cauſes, how unequal ſoever in power, are conſidered as exerting that power on bodies containing a *limited* and comparatively *ſmall*, quantity of electric matter.

“ We have been induced to diſcuſs this ſubject thus particularly, with a view to quiet the minds of the timorous ; as the author's extenſion of his principles reſpecting the returning ſtroke in *artificial* electricity to what paſſes in *natural* electricity, holds out a new, and, in our opinion, groundleſs ſubject of terror to thoſe who in the midſt of their apprehenſions, have hitherto only dreaded the effects of a thunder-ſtorm when it made near approaches to them : but who, if this doctrine were believed, would never think themſelves in ſecurity while a thunder-cloud appeared in ſight, unleſs ſheltered in a houſe furniſhed with proper conductors :—for we ſhould not omit to remark that a ſubſequent obſervation tends to diminiſh their fears, by ſhowing that *high* and *pointed* conductors tend to ſecure both perſons and buildings againſt the various effects of any *returning ſtroke* whatever, as well as of the *main ſtroke*.”

15 Remarkable accident by an electrical exploſion from the earth.

A late melancholy accident which happened in Scotland has afforded Lord Mahon an opportunity of bringing additional arguments in favour of his ſyſtem. An account of this accident is given by Patrick Brydone, Eſq; F. R. S. in the 77th volume of the Philoſophical Tranſactions. It happened on the 19th of July 1785, near Coldſtream on the Tweed. The morning was fine, with the thermometer at 68° ; but about eleven o'clock the ſky became obſcured with clouds in the ſouth-eaſt ; and betwixt twelve and one a ſtorm of thunder and lightning came on. This ſtorm was at a conſiderable diſtance from Mr Brydone's houſe, the intervals between the flaſh and crack being from 25 to 30 ſeconds, ſo that the place of exploſion muſt have been betwixt five and ſix miles off; but while our author was obſerving the progreſs of the ſtorm, he was ſuddenly ſurpriſed with a loud report neither preceded nor accompanied by any flaſh of lightning, which reſembled the exploſion of a great number of muſkets, in ſuch quick ſucceſſion, that the ear could ſcarcely diſcriminate the ſounds. On this the thunder and lightning inſtantly ceaſed, the clouds began to ſeparate, and the ſky ſoon recovered its ſerenity. In a little time Mr Brydone was informed, that a man with two horſes had been killed by the thunder ; and, on running out to the place, our author found the two horſes lying on the ſpot where they had been firſt ſtruck, and ſtill yoked to the cart. As the body of the man who was killed had been carried off, Mr Brydone himſelf had not an opportunity of examining it, but was informed by Mr Bell, miniſter of Coldſtream, who ſaw it, that the ſkin of the right thigh was much burnt and ſhrivelled ; that there were many marks of the ſame kind all over the body, but none on the legs; his clothes, particularly his ſhirt, had a ſtrong ſmell of burning ; and there was a zigzag line of about an inch and a quarter broad, extending from the chin to the right thigh, and which ſeemed to have followed the direction of the buttons of his waiſtcoat. The body was buried in two days without any appearance of putrefaction.

Mr Brydone was informed by another perſon who accompanied him that was killed, of the particular circumſtances. They were both driving carts loaded with coals; and James Lauder, the perſon who was killed, had the charge of the foremoſt cart and was ſitting on the fore part of it. They had croſſed the Tweed a few minutes before at a deep ford, and had almoſt gained the higheſt part of an aſcent of about 65 or 70 feet above the bed of the river, when he was ſtunned with the report abovementioned, and ſaw his companion with the horſes and cart, fall down. On running up to him, he found him quite dead, with his face livid, his clothes torn in pieces, and a great ſmell of burning about him. At the time of the exploſion he was about 24 yards diſtant from Lauder's cart, and had him full in view when he fell; but felt no ſhock, neither did he perceive any flaſh or appearance of fire. At the time of the exploſion his horſes turned round, and broke their harneſs. The horſes had fallen on their left ſide, and their legs had made a deep impreſſion on the duſt; which, on lifting them up, ſhowed the exact form of each leg, ſo that every principle of life ſeemed to have been extinguiſhed at once, without the leaſt ſtruggle or convulſive motion. The hair was ſinged over the greateſt part of their bodies, but was moſt perceptible on their belly and legs. Their eyes were dull and opaque, as if they had been long dead, though Mr Brydone ſaw them in half an hour after the accident happened. The joints were all ſupple, and he could not obſerve that any of the bones were broken or diſſolved, as is ſaid to be ſometimes the caſe with thoſe who are killed by lightning. The left ſhaft of the cart was broken, and ſplinters had been thrown off in many places; particularly where the timber of the cart was connected by nails or cramps of iron. Many pieces of the coal were thrown to a conſiderable diſtance ; and ſome of them had the appearance of being ſome time on a fire. Lauder's hat was torn into innumerable ſmall pieces ; and ſome part of his hair was ſtrongly united to thoſe which had compoſed the crown of it. About four feet and a half behind each wheel of the cart he obſerved a circular hole of about 20 inches diameter, the centre of which was exactly in the track of each wheel. The earth was torn up as if by violent blows of a pick-ax ; and the ſmall ſtones and duſt were ſcattered on each ſide of the road. The tracks of the wheels were ſtrongly marked in the duſt, both before and behind theſe holes, but did not in the ſmalleſt degree appear on the ſpots themſelves for upwards of a foot and a half. There were evident marks of fuſion on the iron rings of the wheels; the ſurface of the iron, the whole breadth of the wheel, and for the length of about three inches, was become bluiſh, and loſt its poliſh and ſmoothneſs, and was formed into drops which projected ſenſibly, and had a roundiſh form; but the wood did not appear any way injured by the heat which the iron muſt have conceived. To determine whether theſe were made by the exploſion which had torn up the ground, the cart was puſhed back on the ſame tracts which he had deſcribed on the road; and the marks of fuſion were found exactly to correſpond with the centres of the holes. They had made almoſt half a revolution after the exploſion; which our author aſcribes to the cart being pulled a little forward by the fall of the horſes. Nothing remarkable was obſerved on the oppoſite part of the wheel. The broken ground had a ſmell ſomething like that of ether; the ſoil itſelf was very dry and gravelly.

The cataſtrophe was likewiſe obſerved by a ſhepherd, at the diſtance of about 200 or 300 yards from the ſpot. He ſaid, that he was looking at the two carts going up the bank when he heard the report, and ſaw the foremoſt man and horſes fall down; but obſerved no lightning, nor the leaſt appearance of fire, only he ſaw the duſt riſe about the place. There had been ſeveral flaſhes of lightning before that from the ſouth-eaſt; whereas the accident happened to the north-weſt of the place where he ſtood. He was not ſenſible of any ſhock.

Our author next gives an account of ſeveral phenomena which happened the ſame day, and which were evidently connected with the exploſion. A ſhepherd tending his flock in the neighbourhood, obſerved a lamb drop down; and ſaid, that he felt at the ſame time as if fire had paſſed over his face, though the lightning and claps of thunder were at a conſiderable diſtance. He ran up to the creature immediately, but found it quite dead; on which he bled it with his knife, and the blood flowed freely. The earth was not torn up; nor did he obſerve any duſt riſe, though he was only a few yards diſtant. This happened about a quarter of an hour before Lauder was killed, and the place was only about 300 yards diſtant.

About an hour before the exploſion, two men ſtanding in the middle of the Tweed, fiſhing for ſalmon, were caught in a violent whirlwind, which felt ſultry and hot, and almoſt prevented them from breathing. They could not reach the bank without much difficulty and fatigue; but the whirlwind laſted only a very ſhort time, and was ſucceeded by a perfect calm.

A woman making hay, near the banks of the river, fell ſuddenly to the ground, and called out that ſhe had received a violent blow on the foot, and could not imagine from whence it came; and Mr Bell, the miniſter abovementioned, when walking in his garden, a little before the accident happened to Lauder, felt ſeveral times a tremor in the ground.

16
Mr Brydone's concluſions from the facts.

The concluſion drawn from theſe facts by Brydone is, that at the time of the exploſion the equilibrium between the earth and the atmoſphere ſeems to have been completely reſtored, as no more thunder was heard nor lightning obſerved; the clouds were diſpelled, and the atmoſphere reſumed the moſt perfect tranquillity: "But how this vaſt quantity of electric matter (ſays he) could be diſcharged from the one element to the other, without any appearance of fire, I ſhall not pretend to examine. From the whole it would appear, that the earth had acquired a great ſuperabundance of electrical matter, which was every where endeavouring to fly off into the atmoſphere. Perhaps it might be accounted from the exceſſive dryneſs of the ground, and for many months the almoſt total want of rain, which is probably the agent that nature employs in preſerving the equilibrium between the two elements."

17
Arguments drawn by Earl Stanhope in favour of his ſyſtem.

Lord Mahon, now Earl Stanhope, whoſe obſervations on this accident are publiſhed in the ſame volume, endeavours to eſtabliſh the following poſitions as facts.

1. That the man and horſes were not killed by any *direct main ſtroke of exploſion* from a thunder-cloud either poſitively or negatively electrified.

2. They were not killed by any *tranſmitted main ſtroke* either poſitive or negative.

3. The miſchief was not done by any *lateral exploſion*. All theſe are evidently true, at leaſt with reſpect to lightning at that time falling from the clouds; for all the lightning which had taken place before was at a great diſtance.

4. They were not ſuffocated by a ſulphureous vapour or ſmell which frequently accompanies electricity. This could not account for the pieces of coal being thrown to a conſiderable diſtance all round the cart, and for the ſplinters of the wood which were thrown off from many parts of the cart.

5. It might be imagined by ſome that they were killed by the violent commotion of the atmoſphere, occaſioned by the vicinity of the electrical exploſion, in a manner ſimilar to the fatal wounds that ſometimes have been known to have been given by the air having been ſuddenly diſplaced by a cannon-ball in its paſſage through the atmoſpherical fluid, though the cannon-ball itſelf had evidently neither ſtruck the perſon wounded nor grazed his clothes. The duſt that roſe at the time of the exploſion might be brought as an argument in favour of the opinion, that a ſudden and violent commotion of the air did occaſion the effects produced. But ſuch an explanation would not account for the marks of fuſion on the iron of the wheels, nor for the hair of the horſes being ſinged, nor for the ſkin of Lauder's body having been burnt in ſeveral places.

6. From theſe different circumſtances his Lordſhip is of opinion, that the effects proceeded from electricity; and that *no electrical fire did paſs* immediately, either from the clouds into the cart, or from the cart into the clouds. From the circular holes in the ground, of about 20 inches diameter, the reſpective centres of which were exactly in the track of each wheel, and the correſponding marks of fuſion in the iron of the wheels, it is evident that the electrical fire did paſs from the earth to the cart, or from the cart to the earth, through that part of the iron of the wheels which was in contact with the ground. From the ſplinters which had been thrown off in many places, particularly where the timber was connected by nails or cramps of iron, and from various other effects mentioned in Mr Brydone's account, it is evident, that there muſt have been a great commotion in the electrical fluid in all, or at leaſt in different parts of the cart, and in the bodies of the man and horſes, although there were no lightning.

7. All theſe phenomena, his lordſhip argues, may be explained in a ſatisfactory manner from the doctrine already

already laid down concerning the returning ſtroke. Before entering upon the ſubject of the main exploſion, however, he takes notice of the other phenomena already mentioned in Mr Brydone's account.

With regard to the caſe of the lamb, his lordſhip is of opinion, that it belongs to the moſt ſimple claſs of returning ſtrokes, *viz.* that which happens at a place where there is neither thunder nor lightning near; and that it may be produced by the ſudden removal of the elaſtic electrical preſſure of the electrical atmoſphere of a *ſingle* main cloud, as well as of an aſſemblage of clouds. It appears (ſays he) by Mr Brydone's account, that the ſhepherd who ſaw the lamb fall, was near enough to it to feel, in a ſmall degree, the electrical returning ſtroke at the ſame time that the lamb dropped down.—The blow which the woman received on the foot was unqueſtionably the returning ſtroke. When a perſon walking, or ſtanding out of doors, is knocked down or killed by the returning ſtroke, the electrical fire muſt ruſh in, or ruſh out, as the caſe may be, through the perſon's feet, and through them only; which would not be the caſe were the perſon to be killed by any main ſtroke of exploſion either poſitive or negative.

8. In order to account for the manner in which the man and horſes were killed, his lordſhip premiſes, that, according to Mr Brydone's acount, the cloud muſt have been many miles in length; inſomuch as juſt before the report the lightning was at a conſiderable diſtance, *viz.* between five and ſix miles. The loud report reſembled the firing of ſeveral muſkets ſo cloſe together, that the ear could ſcarcely ſeparate the ſounds, and was followed by no rumbling noiſe like the other claps. This indicates, that the exploſion was not far diſtant, and likewiſe that it was not extremely near: for, if the exploſion had been very near, the ear could not at all have ſeparated the ſounds.

18
Hypotheſis by which he accounts for the phenomena.

9. Let us now ſuppoſe a cloud, eight, ten, or twelve miles in length to be extended over the earth, and let another cloud be ſituated betwixt that and the earth; let them alſo be ſuppoſed charged with the ſame kind of electricity, and both poſitive. Let us farther ſuppoſe the lower cloud to be near the earth, only a little beyond the ſtriking diſtance; and the man, cart, and horſes, to be ſituated under that part of the cloud which is next the earth, and to be exactly as deſcribed by Mr Brydone, *viz.* near the ſummit of an hill, and followed by another a little farther down; and let us ſuppoſe the two clouds to be near each other juſt over the place where the man and horſes are: Let the remote end of the cloud approach the earth, and diſcharge its electricity into it. In this caſe the following effects will take place.

10. When the upper cloud diſcharges its electricity into the earth from the remote end, the lower cloud will diſcharge its electricity into the nearer end of the upper cloud, which is ſuppoſed to be directly over the place of the cart and horſes, or nearly ſo. This accounts for the loud report of thunder that was unaccompanied by lightning. The report muſt be *loud* from its being near; but no *lightning* could be perceived, by reaſon of the thick cloud ſituated immediately between the ſpectator and the ſpace betwixt the two clouds where the lightning appears.

11. As the lower cloud gradually approached towards the earth, that part of the latter where the man and horſes were muſt of courſe become ſuperinduced by the elaſtic electrical preſſure of the electrical atmoſphere of the thunder-cloud; which ſuperinduced elaſtic electrical preſſure muſt gradually have increaſed as the cloud came cloſer to the earth, and approached nearer to the limit of the ſtriking diſtance.

12. Hence, if any conducting body (not having prominent or conducting points) were to be placed upon the ſurface of the earth, and there electrically inſulated; then ſuch conducting body, by the laws of electricity, muſt, at its upper extremity (namely the part neareſt to the poſitive cloud) become *negative*; at its lower extremity it muſt become *poſitive*; and, at a certain intermediate point, it will be neither *plus* nor *minus*. This inſulated conducting body, thus ſituated, will be in three oppoſite ſtates at the ſame time, that is to ſay, it will be at the ſame time, poſitively electrified, negatively electrified, and not electrified at all.—For a demonſtration of this propoſition, his lordſhip refers to his Principles of Electricity; but it is a generally known and eſtabliſhed fact in electricity.

13. If this conducting body on the ſurface of the earth be not inſulated, or be but imperfectly inſulated, then the whole of ſuch body, from its being immerged in the electrical atmoſphere of the poſitive cloud, will become negative; becauſe part of the electricity of the conducting body will in this caſe paſs into the earth; and the conducting body will become the more negative as it becomes the more deeply immerged into the denſe part of the elaſtic electrical atmoſphere of the approaching thunder-cloud.

14. When the lower cloud comes ſuddenly to diſcharge with an exploſion its ſuperabundant electricity into the upper one, then the elaſtic electrical atmoſphere of the former will ceaſe to exiſt; conſequently the electrical fluid, which had been gradually expelled into the common ſtock from the conducting body on the ſurface of the earth, muſt, by the ſudden removal of the ſuperinduced elaſtic electrical preſſure of the electrical atmoſphere of the thunder-cloud, ſuddenly return from the earth into the ſaid conducting body, producing a violent commotion ſimilar to the pungent ſhock of a Leyden jar in its ſenſation and effects.

19
Suppoſed effects of the returning ſtroke.

15. This, which his lordſhip calls *the electrical returning ſtroke*, he ſuppoſes to have been what killed the man and horſes in the preſent caſe, they having become ſtrongly negative before the exploſion. The man, according to Mr Brydone's account, was ſitting when he received the ſtroke, and his legs were hanging over the fore part of the cart at the time of the exploſion. The returning ſtroke, therefore, could not enter his body through the legs; and this accounts for the ſkin of his legs not having been at all burnt or ſhrivelled, as the ſkin was on many other parts of his body; and it likewiſe ſhows the reaſon why the zigzag line, which was terminated by the chin, did not extend lower than the thigh.

16. Mr Brydone likewiſe informs us, that the hair of the horſes was much ſinged over the greateſt part of their bodies, but was moſt perceptible on the belly and legs. This is eaſily accounted for by the returning ſtroke; for the lower part of the bodies of theſe animals muſt of courſe have been more affected than any other part, as the electrical fire muſt have ruſhed ſuddenly into their bodies through their legs, which had made a deep impreſſion on the duſt.

17. The various effects produced on the cart may be explained alſo from the returning ſtroke with equal facility. The ſplinters were thrown off by reaſon of the interruption of good conductors; the wood being a much leſs perfect conductor than the iron. It is alſo evident, that it was the electrical returning fire that produced the marks of fuſion on that part of the iron of the wheels which was in contact with the ground; inaſmuch as the whole electricity, at the inſtant of the exploſion, did enter at theſe places.

18. No perſon in the leaſt verſed in the principles of electricity can heſitate to aſſent to the propoſition, that the electrical returning ſtroke muſt exiſt under circumſtances ſimilar to thoſe explained above; but it may be objected, as the reviewers formerly did, that the quantity of electricity naturally contained in the body of a man, &c. is by far too ſmall to produce ſuch violent effects. For an anſwer to this objection, his lordſhip refers to his book: By way of corroboration, however, he makes the following remarks.

20
Great ſtrength of the returning ſtroke in certain caſes.

19. No perſon can reaſonably conclude, that the force of a returning ſtroke muſt always be weak when produced by the diſturbed electrical fluid of a man's body, by reaſon that a man's body contains but a ſmall quantity of electricity: for it has never been proved that a man's body contains only a ſmall quantity of electrical fluid; neither is there the ſmalleſt reaſon to believe ſuch an hypotheſis, which appears, on many accounts, to be completely erroneous; and if that hypotheſis be erroneous, the objection to the ſtrength of an electrical returning ſtroke remains altogether unſupported by argument. "When a body is ſaid to be *plus* or *poſitive* (ſays his lordſhip), it ſimply means, that the body contains more than its natural ſhare of electricity, but does not ſay that it is completely ſaturated with it. In like manner, when a body is ſaid to be *minus* or *negative*, it only ſignifies, that the body contains *leſs* than its natural ſhare of electricity; but does not imply that ſuch a body is *completely exhauſted* of the electricity which it contains in its natural ſtate. "Now (ſays he), the ſtrength of natural electricity is ſo immenſe, when compared with the very weak effects of our largeſt and beſt contrived electrical machines, that I conceive we cannot, by means of artificial electricity, expel, from a man's body, the thouſandth, or perhaps the ten-thouſandth part of the electrical fluid which it contains when in its natural ſtate."

20. An hypotheſis which eaſily accounts for any natural phenomenon has a much better claim to our attention than an oppoſite one, which prevents it from being intelligibly explained. There is no reaſon to conclude that any electrical machine, of any given ſize, is capable of rendering a conducting body either *completely plus* or *completely minus*; but far otherwiſe. And it would have been as logical for any perſon ſome years ago (when electrical machines were not brought to their preſent ſtate) to have maintained, that thoſe very imperfect machines were capable of rendering a body *completely poſitive* or *completely negative*, as for us to pretend to do it at this day. We evidently have not, with our machines, even approached the limit of electrical ſtrength, particularly in reſpect to the returning ſtroke: for it is remarkable, that, by the laws of electricity, the ſtrength of the electrical *returning ſtroke*, near the limit of the ſtriking diſtance, does increaſe in a greater ratio than the ſtrength of the main ſtroke from the charged body producing the elaſtic electrical atmoſphere ſuperinduced. Thus, let us attempt to produce the returning ſtroke by means of a metallic conductor of about 20 or 21 inches in length and of about two inches in diameter; and by means of another metallic body of equal dimenſions placed parallel to the prime conductor, juſt out of the limit of the ſtriking diſtance; and let the prime conductor be charged by one of the common glaſs globes of leſs than nine inches in diameter; the returning ſtroke in this caſe will be ſo weak, that it can hardly be ſaid to exiſt: but if the experiment be made by means of a large cylinder, and by means of a metallic prime conductor of about three feet four inches long, by nearly four inches and an half diameter, and alſo by means of another metallic body of equal dimenſions with this prime conductor, then there will be no kind of compariſon betwixt the ſtrength of the returning ſtroke obtained out of the ſtriking diſtance, and the ſtrength of the main ſtroke received immediately from the prime conductor; the ſharpneſs and pungency of the returning ſtroke being ſo much ſuperior. The returning ſtroke in this caſe is like the ſudden diſcharge of a weakly electrified Leyden jar, provided due attention be paid to the rules for obtaining a ſtrong returning ſtroke.

21
Strength of the returning ſtroke in different circumſtances.

21. In the caſe of a returning ſtroke, the ſtrength depends, according to his lordſhip's hypotheſis, not ſo much on the *quantity* of the electric fluid, as on its *velocity*; whence alſo it depends leſs on the quantity of ſurface uſed than on the ſtrength of the electrical preſſure of the elaſtic electrical atmoſphere ſuperinduced upon the body ſtruck previous to the exploſion. But the electrical preſſure of the elaſtic electrical atmoſphere of the great thunder-cloud which produced the miſchief on the preſent occaſion, muſt have been immenſely greater than that of a metallic prime conductor; and it is not ſurpriſing that the effects ſhould be proportioned to the cauſes.

22
Why the returning ſtroke was not felt by the man who drove the ſecond cart.

22. His lordſhip next accounts for the returning ſtroke not being felt by the man who followed Lauder's cart. This, he thinks, may in ſome degree be accounted for by the latter having been higher up the bank; though it may better be done by ſuppoſing the cloud to have been pending nearer the earth over the ſpot where Lauder was killed, than over the place where his companion was; for, in order to receive a dangerous returning ſtroke, it is neceſſary that he ſhould be immerged, not merely in the cloud's atmoſphere, but in the denſe part of the cloud's electrical atmoſphere. It may alſo be accounted for by ſuppoſing that the ſecond cart were either better connected with the common ſtock, or better inſulated; for either of theſe circumſtances will weaken a returning ſtroke prodigiouſly. Now Mr Brydone mentions, that there had been an almoſt total want of rain for many months. He alſo ſays, that the ground, at the place where Lauder was killed, was remarkably dry, and of a gravelly ſoil. This ſtate of the ground was particularly adopted to the production of the electrical returning ſtroke, when produced upon the large ſcale of nature, where the elaſtic electrical preſſure is ſo powerful.

To theſe arguments adduced by his lordſhip for the exiſtence and ſtrength of the electrical returning ſtroke, we ſhall add an account of ſome experiments publiſhed

23 Experiments with an inſulated conductor.

in the Gentleman's Magazine for 1758. They were made with an inſulated rod of iron of conſiderable length, riſing ſome feet higher than a common conductor placed at the other end of the houſe. A ſet of bells were affixed to the former, which in a thunder ſtorm, even when the thunder was four or five miles diſtant, was rung by the electricity of the atmoſphere; but whenever a flaſh of lightening burſt from the cloud, even though at the diſtance juſt mentioned, the *ſame flaſh*, according to our author, paſſed through the conductor alſo, and the bells ceaſed to ring ſometimes for ſeveral ſeconds; then they began again, and continued to ring till they were ſtopped by another flaſh. This flaſh which paſſed thro' the conductor was undoubtedly what earl Stanhope calls *the returning ſtroke*; of which we muſt now give ſome explanation: And in conſidering the whole doctrine of that ſtroke, together with the particular explanation laid down by his lordſhip, the following obſervations naturally occur.

24 Deceptions in Earl Stanhope's experiments.

1. In the experiments made by his lordſhip to demonſtrate the exiſtence of the returning ſtroke, there is a deception, of which the reviewers take notice, *viz* that the man touches a large prime conductor, which, by the operation of the machine, becomes negatively electrified as well as himſelf. Hence when the diſcharge is made, all the fire returning to that conductor muſt paſs through his body as well as that of which his body itſelf is ſuppoſed to be deprived; and this, though no other cauſe intervened, muſt nearly double the ſtrength of the ſhock. To make the experiment more fairly, it would be neceſſary to take away this ſecond conductor, and let the man only touch the braſs ball communicating with the earth.

2. In this experiment there is another deception, not taken notice of by the reviewers, *viz.* that any body immerſed in a poſitive electrical atmoſphere becomes negative. Hence the ſecond conductor, by being applied to the air poſitively electrified by the machine, becomes almoſt as ſtrongly negative as if another machine had been applied to it on purpoſe; and this negative electricity will be the ſtronger in proportion to the ſtrength of electricity in the air ſurrounding it. Again, it is well known that a plate of air may be charged by means of two ſmooth pieces of metal held at a ſmall diſtance from each other, one of them connected with an electrical machine, and the other with the earth. Now ſuppoſing inſtead of the uſual communication, that a man ſtanding upon an inſulating ſtool, held the lower metallic plate in one hand, and with the other hand touched the earth, or a conductor communicating with it, it is plain, that by touching the upper plate, the electricity acquired by the air between them would be diſcharged, and that the man would feel what earl Stanhope calls the *returning ſtroke*; but which in truth is the ſhock of a charged electric ſubſtance, and would therefore be proportionably pungent. Now, in his lordſhip's experiments, the two conductors anſwer exactly to the two metallic plates above mentioned; the air between them receives a charge, and is diſcharged by the exploſion from the prime conductor, becauſe this conductor forms one of the charging plates. It is true, that the round ſhape of the conductors renders them unfavourable for trying the experiment; and this is one reaſon why it requires a great power of electricity to make the returning ſtroke ſenſible. The thickneſs of the plate of air interpoſed betwixt the two conductors is another reaſon: but this makes no difference as to the principles; for his lordſhip's experiment is undoubtedly no other than that of the Leyden phial. Were his lordſhip to uſe two flat plates inſtead of round conductors, the deception would then be removed; and we may venture to determine *a priori*, that the returning ſtroke would then be not only very ſevere, but even *dangerous*, with a very powerful machine and large plates.

25 Returning ſtroke not different from that of a charged phial.

3. Though the ſecond conductor were entirely removed, yet there would ſtill be a deception in this experiment, for then the ſurface of the man's body would act in ſome meaſure as one of the metallic plates; ſo that ſtill the experiment would be on the principles of the Leyden phial, though much weaker than before.

26 How the experiment ſhould be properly made.

4. In order to make this experiment abſolutely without deception the man ſhould ſtand upon the ground without touching any thing; and in that caſe we may venture to affirm, that he would feel no returning ſhock. His being inſulated varies the nature of the experiment entirely, as will eaſily be underſtood from the following conſiderations.

27 Another explanation of the phenomena.

Under the article ELECTRICITY, we have ſhown, that *poſitive* electricity does not conſiſt in *accumulation*, nor *negative* electricity in a *deficiency*, of the fluid; but that all electric phenomena are to be accounted for from the mere *motion* of the fluid, and that this motion is always a circulation. We have ſhown, that in the working of a common machine, the electric fluid comes from the earth; that it is accumulated around the prime conductor: evaporates in the air; and is then ſilently abſorbed by the earth, and reconducted to the machine. Hence, in the charging of a machine which works poſitively, the earth, and all bodies on its ſurface, for ſome way round, are in a negative ſtate; becauſe they are then abſorbing the electrical fluid from the atmoſphere. That part of the earth indeed directly under the feet of the machine, and perhaps ſome little way farther, is *poſitive*; becauſe it is *giving out* electricity: but the negative portion will be much more extenſive. When the conductor is diſcharged by a ſpark, then the circulation ceaſes in a great meaſure by the colliſion of the two oppoſite ſtreams of electric matter. All bodies on the ſurface of the earth then, as far as it was negatively electrified, muſt receive what his lordſhip calls the *returning ſtroke*: but the electricity being diffuſed among ſuch a number, and over ſuch a wide extent, it is no wonder that it ſhould be inſenſible. If, however, we inſulate a large conducting body, and and another part of it communicate with the earth by means of a good conductor, we inſtantly put it in a ſituation fit for tranſmitting more than its ſhare of the electricity of the atmoſphere, and reducing it to the ſtate of the inſulated rubber of an electrical machine, through which the whole quantity of electricity muſt paſs to the phial held towards it, in order to be charged negatively. In proportion to this quantity tranſmitted the ſhock muſt be, not becauſe the conductor has loſt a large ſhare of its *natural* electricity, but becauſe a large quantity is *artificially* made to paſs through it. We may therefore ſafely venture to aſſert that, in thunder-ſtorms unleſs a body tranſmits *more than*

than its natural proportion of electric matter, no ſhock will be felt, much leſs can the perſon be killed.

28
Difficulties which occur in his lordſhip's hypotheſis.

5. In his explanation of the accident which happened to Lauder, his lordſhip is reduced to the greateſt difficulty, and makes one of the moſt unphiloſophical ſhifts in the world; no leſs than that of arranging the *clouds of heaven*, not according to fact, but according to his own imagination. He ſuppoſes the exiſtance of two clouds, one below the other; and aſcribes to them various motions and ſituations, which we have already taken notice of: but who knows whether ſuch clouds ever exiſted? His lordſhip does not pretend that any body ever ſaw them; and thus he runs into what is termed by logicians a *vicious circle:* he firſt aſſumes data, purpoſely made to accord with his hypotheſis, and then proves the hypotheſis from the data.

6. Granting the arrangement of the clouds, and every thing his lordſhip deſires, the main requiſite is ſtill wanting, *viz.* a flaſh of lightning at a diſtance to produce the returning ſtroke. According to him, the diſtant flaſh and returning ſtroke muſt be ſimultaneous; but Mr Brydone mentions no ſuch thing: on the contrary, there had been no flaſh for ſome little time before; and the immenſe velocity of the electric fluid will not allow us to ſuppoſe that it would take up the uſual time betwixt thunder-claps in travelling five or ſix miles.

7. His lordſhip accounts for no lightning being ſeen at the time of the exploſion in a very arbitrary and unnatural manner, by ſuppoſing it to have proceeded from a diſcharge of the one imaginary cloud into the other; and that it was not *ſeen* on account of the thickneſs of the lower cloud. A much more natural ſuppoſition muſt be, that it happened below the cart-wheels, but was not ſeen on account of its being day-light, and the cloud of duſt which it raiſed. The ſucceſſion of noiſes, too, indicated a ſucceſſion of exploſions, the flaſhes of which would be leſs eaſily obſerved than a ſingle large one.

8. It ſeems altogether impoſſible, that the *return* of any quantity of *natural* electricity into a body ſhould ſhatter that body to pieces. In the preſent caſe, the fire entered by a ſmall part of the iron of the wheels, and this part was melted. His lordſhip does not heſitate to own, that the fuſion was a proof that the *whole* fire belonging to the cart, man, and horſes, or at leaſt to the cart and man, had entered by this part of the wheels, and conſequently *more* than naturally belonged to that ſmall part of iron. The ſame evidence, however, will hold good with regard to every other part. We grant that the fire entered the man's body by his right thigh: this might have therefore been burnt by receiving the fire belonging to the whole body; but it ought then to have quietly diffuſed itſelf through the other parts of his body, or at leaſt if any damage had been done, it ought to have been done only to the internal parts. Inſtead of this, a broad zig-zag line upon his body indicated a vaſt quantity of electric matter running along the ſurface without entering the body at all. In like manner, his hat being torn in pieces, indicated a violent exploſion of electric matter at his head, where there ought to have been little or no exploſion, as none could be wanted there except what the *hat* had parted with; and it is ridiculous to ſuppoſe that *hats* part with ſuch quantities of electricity as would tear them in pieces by its return. The ſhivering of the cart, the burning and throwing about of the coals, and all the other circumſtances of the caſe, alſo point out in the cleareſt manner, not a quantity of electric matter returning to ſupply any natural deficiency, but an enormous exploſion of that matter from the earth overwhelming and deſtroying whatever ſtood in its way. That *two* exploſions were made from the earth is very evident, becauſe there were two holes in it; and the very ſize of theſe holes indicates a much greater diſcharge of electricity than we can *reaſonably* ſuppoſe to have been loſt by the man, horſes, and cart.

29
Phenomena of the inſulated thunder-rod, accounted for.

We ſhall now conſider the experiment quoted from the correſpondent in the Gentleman's Magazine. Theſe, as well as the accident under conſideration, undoubtedly ſhow, that, during the time of a thunder-ſtorm, both atmoſphere and earth are affected for a very conſiderable way. With regard to the *quantity* of this electrical affection, however, though it muſt undoubtedly be exceſſive when taken altogether, we can by no means agree that it is ſo taken partially. From an experiment related in the Magazine above quoted, it appears, that the electricity of a violent thunder-ſtorm extends ſometimes over a circle of 100 miles diameter. "Electricity (ſays the author) ſeldom appeared without a ſhower; but I was ſurpriſed, on the 5th of June 1784, that the bells rang with thin and very high clouds, and without the leaſt appearance of rain, till the next poſt brought me an account of a violent thunder-ſtorm, and very deſtructive hail, at a village 50 miles diſtant." We cannot by any means ſuppoſe, that all this ſpace was electrified like a charged phial; otherwiſe, great as the exploſions of lightning are, they would ſtill be much greater. This is evident even in our electrical machines. A ſingle phial may be charged much higher than a battery, as appears by the electrometer; but the battery, though leſs charged, will have incomparably more power than a ſingle phial. His lordſhip appears to have deceived himſelf in this matter, by miſtaking the *extent* of the electrified ſurface for the *quantity* of charge in every part of it. The ſurface of the earth in a thunder-ſtorm is exactly ſimilar to that of a charged conductor. According to the extent of electrified ſurface, the ſpark will be great or ſmall; and juſt ſo it is with lightning, for ſome kinds of it are much more deſtructive than others. In all caſes, however, the *quantity* of electricity in a particular ſpot is very inconſiderable. Lightning ſtrikes bodies, not becauſe they are highly electrified, but becauſe they afford a communication betwixt the atmoſphere and ſome place below the ſurface of the earth. This ſtroke is the aggregate of the whole electricity contained in a circle of probably many miles in diameter; but the returning ſtroke, if bodies are in their natural ſtate, can only be in proportion to the *quantity* of electricity in each ſubſtance contained within that ſpace. It is in fact the lightning itſelf diffuſed through the earth which makes the returning ſtroke; and it is impoſſible that every ſubſtance within two or three miles of the exploſion can receive the whole flaſh, or another equal to it. It is only in caſes where the quantity of electricity, diffuſed through a great ſpace, happens to diſcharge

30
Of the *quantity* of electricity in any given portion of the earth's ſurface.

itſelf through a human body or other conducting ſubſtance of no great bulk, that the effects upon the latter can be any way conſiderable. This was undoubtedly the caſe with the thunder-rod mentioned by the correſpondent in the Magazine; for it received either from the atmoſphere or from the earth, at the time of every flaſh, the whole quantity of electricity which had been diffuſed for a conſiderable way round. Pointed bodies, we know, draw off electricity very powerfully; inſomuch that an highly charged jar may be deprived of almoſt all its power by merely preſenting a needle to it. We can be at no loſs therefore to underſtand why a pointed conductor ſhould draw off the electricity from a large portion of the ſurface of the earth, or from a conſiderable portion of the atmoſphere.

We muſt now, however, inquire into the reaſon of theſe appearances of ſparks in places at ſuch diſtance from the exploſion of the lightning. To underſtand this we muſt always keep in our eye that principle ſo fully explained under the article ELECTRICITY, viz. that there never is, nor can be a real *deficiency* of the electric fluid in any ſubſtance or in any place. It is to be conſidered as an abſolute *plenum*, and of conſequence it can have no other motion than a circulatory one. At every diſcharge of lightning therefore from the clouds into the earth, or from one cloud into another, there muſt be a return of the ſame quantity to thoſe clouds which have made the diſcharge. In the vaſt extent of electrified ſurface, ſome part of theſe returns muſt undoubtedly be made at great diſtances from the place where the exploſion of lightning happens. As long as matters remain in their natural ſtate, the electric matter will return by innumerable paſſages in ſuch ſmall ſtreams, that no perceptible effect upon any ſingle ſubſtance can take place. But if a body be ſo ſituated, that a large portion of the electric matter muſt return through it from the earth, then ſuch body will undoubtedly be more affected by every flaſh than the reſt of the ſubſtances around it; and if the communication with the earth be interrupted, a flaſh of fire will be perceived betwixt the conducting ſubſtance and the earth at the time that a flaſh burſts out from the cloud. The ſtrength of ſuch a flaſh, however, muſt by no means be ſuppoſed equivalent to that of the *main* ſtroke of lightning, unleſs we could ſuppoſe the whole electrical power of the vaſt circle already mentioned to be diſcharged through the conductor.

31
Particular explanation of the accident.

But though this may explain the reaſon of the ſparks or flaſhes obſerved in the caſe of the thunder-rod juſt mentioned, we cannot from this principle account for the accident which befel the man and horſes. There was indeed at that time a very violent emiſſion of electricity from the earth, but no diſtant flaſh of lightning happened at the ſame moment with it, to expel the electricity from the earth. It appears therefore, that the electricity had in this caſe been accumulating in the earth itſelf, in a manner ſimilar to that which produces earthquakes; and which is fully explained under that article. The thunder-ſtorm was the natural means employed to ſupply that part of the earth with electricity, which was in the ſtate of charging; and the moment that the quantity thus ſupplied was thrown back, all ſigns of electricity muſt ceaſe, as much as when that thrown in upon one ſide of a Leyden phial is again thrown off. Hence, when the flaſh burſt out of the earth, and killed the man and horſes, that portion of earth which abſorbed the electricity till then, required it no longer; and of conſequence the thunder-ſtorm occaſioned by this abſorption naturally ceaſed.

That this diſpoſition to an earthquake did really prevail in the earth at that time, is evident from the *tremor* which Mr Bell felt on the ground when walking in his garden. The ſtroke which the woman received on the foot, the death of the lamb, and no doubt many ſimilar circumſtances, concurred to ſhow that there was an attempt to reſtore the equilibrium from the earth, as has been already related. The ſame diſpoſition to an earthquake, however, was afterwards renewed; and on the 11th of Auguſt that ſame year, a ſmart ſhock of an earthquake did actually take place, as Mr Brydone informs us in the ſame paper.

Beſides the different kinds of lightning already treated of, it is by no means uncommon to ſee flaſhes unattended by any report. Theſe are always of the ſheet kind; they happen very frequently in windy weather when the ſky is clear; and likewiſe when the ſky is cloudy, immediately before a fall of rain or ſnow. The general reaſon of theſe appears to be, that the electric fluid is the medium by which the vapours are ſuſpended in the atmoſphere; and of conſequence, every ſeparation of vapour, whether as rain, ſnow, or hail, muſt be attended with what is called a *diſcharge* of electrical matter. The reaſon why this kind of lightning is never attended with any report is, that there is no particular object againſt which the force of the flaſh is directed; but it diſſipates itſelf among the innumerable conducting bodies with which the atmoſphere always abounds. It is, however, in a manner impoſſible to explain the various ways, in which this ſubtile fluid acts. We know not, for inſtance, in what ſtate it is when acting as a medium of connection betwixt the air and vapour, nor in what its *diſcharge* into other parts of the atmoſphere properly conſiſts. At any rate, we ſee that a flaſh of lightning, however limited its extent may appear to us, diffuſes its effects over a great ſpace of atmoſphere; for after one of theſe ſilent flaſhes it is no uncommon thing to obſerve the ſky to become obſcure though it had been quite ſerene before; or, if it had been cloudy, to ſee rain or ſnow begin to fall in a very few minutes. It is probable indeed, that there is no change whatever that can take place in the atmoſphere but by means of electricity; and there is great reaſon to believe, that the ſilent diſcharges of this fluid from one part of the atmoſphere to another, many of which are totally inviſible, ultimately occaſion the whole of the phenomena of METEOROLOGY. See that article.

32
Directions for conducting rods.

Various parts of his Lordſhip's Treatiſe on Electricity, beſides thoſe already quoted, tend to prove the utility of *high* and *pointed* conductors, in preference to thoſe which terminate in a *ball*, or *rounded end*. Towards the end of the performance, the author diſcuſſes this matter very particularly; and enumerates the '*neceſſary requiſites*' in erecting them, in number 11; to every one of which we readily ſub-

ſubſcribe. As this matter is of a popular nature, and on a ſubject generally intereſting, we ſhall tranſcribe this liſt; adding a ſhort explanation to particular articles.—Theſe requiſites (ſays the author) are 11 in number.

‘ 1ſt, That the rod be made of ſuch ſubſtances as are, in their nature, the *beſt conductors of electricity*.

‘ 2dly, That the rod be *uninterrupted*, and *perfectly continuous*.’—This is a very material circumſtance. One entire piece of metal cannot perhaps be had: but it is not ſufficient that the rods, of which the conductor conſiſts, be *ſenſibly* in contact; they ſhould be preſſed into *actual* contact by means of nuts and ſcrews, with a thin piece of ſheet-lead between the ſhoulders of the joints.

‘ 3dly, That it be of a *ſufficient thickneſs*.’—A *copper* rod half an inch ſquare, or an *iron* rod one inch ſquare, or one of *lead* two inches ſquare, are thought fully ſufficient by the author.

‘ 4thly, That it be perfectly connected with the common ſtock.’—That is, it ſhould be carried deep into the earth, which is frequently dry near the ſurface; and then continued in a horizontal direction, ſo as to have the farther extremity dipped, ſhould this be practicable, into water, at the diſtance of 10 yards or more from the foundation.

5thly, That the upper extremity of the rod be as *acutely pointed* as poſſible.’—This termination ſhould be of copper; or rather a very fine and exceedingly acute needle of *gold* ſhould be employed, which will not materially add to the expence.

‘ 6thly, That it be very finely tapered:’—ſo that the upper extremity may be a cone, the diameter of the baſe of which may bear an extremely ſmall proportion to its height; for inſtance, that of *one* to *forty*.

‘ 7thly, That it be extremely prominent;’—that is, 8, 10, or 15 feet at leaſt above the higheſt parts of the building. The author lays great ſtreſs on this circumſtance; in conſequence of the law abovementioned, deduced by him from his experiments, relating to electric atmoſpheres. According to this law, the denſity of an electric atmoſphere (the *negative* atmoſphere, for inſtance, of the roof of a houſe, &c. while a *poſitively* charged cloud hangs over it) diminiſhes in the inverſe ratio of the *ſquare* of the diſtance from the ſurface of the body to which that atmoſphere belongs. Accordingly, if the rod project 12 feet into this atmoſphere, it will reach to a part of it *four* times leſs denſe than if the rod projected only to *half* that diſtance, or ſix feet;—and to a part *one hundred and forty four* times rarer, than if it projected only *one* foot.

‘ 8thly, That each rod be carried, in the ſhorteſt convenient direction, from the point at its upper end, to the common ſtock.

‘ 9thly, That there be neither large nor prominent bodies of metal upon the top of the building propoſed to be ſecured, but ſuch as are connected with the conductor, by ſome proper metallic communication.

‘ 10thly, That there be a *ſufficient number* of high and pointed rods.’—On edifices of great importance, eſpecially magazines of gun-powder, the author thinks theſe ought never to be above 40 or 50 feet aſunder.

‘ 11thly, That every part of the rods be very ſubſtantially erected.’

The author declares that he has ‘ never been able to hear of a *ſingle* inſtance, nor does he believe that any one can be produced, of an *high*, *tapering*, and *acutely pointed* metallic conductor, having ever, in any country, been ſtruck by lightning; if it had *all* the neceſſary requiſites abovementioned, eſpecially the ſecond and fourth.’

33 Uſe of conductors.

On the whole, it ſeems to be pretty certain, that both pointed and knobbed metalline conductors have the power of preſerving any body placed at a ſmall diſtance from them from being ſtruck by lightning. This they do, not becauſe they can *attract* the lightning far out of its way, but becauſe the reſiſtance to its paſſage is always leaſt on that ſide where they are; and as pointed conductors diminiſh the reſiſtance more conſiderably than blunt ones, they ſeem in all caſes to be preferable.—It appears, however, that a ſingle conductor, whether blunt or pointed, is not capable of ſecuring all the parts of a large building from ſtrokes of lightning; and therefore ſeveral of them will be required for this purpoſe: but to what diſtance their influence extends, hath not been determined, nor does it ſeem eaſily capable of being aſcertained.

34 Why lightning ſometimes kills alternately.

It now remains only to explain ſome of the more uncommon appearances and effects of lightning. One of theſe is, that it is frequently obſerved to kill alternately: that is, ſuppoſing a number of people ſtanding in a line; if the firſt perſon was killed, the ſecond perhaps would be ſafe; the third would be killed, and the fourth ſafe; the fifth killed, &c.—Effects of this kind are generally produced by the moſt violent kind of lightning; namely, that which appears in the form of balls, and which are frequently ſeen to divide themſelves into ſeveral parts before they ſtrike. If one of theſe parts of a fire-ball ſtrike, a man, another will not ſtrike the perſon who ſtands immediately cloſe to him; becauſe there is always a repulſion between bodies electrified the ſame way. Now, as theſe parts into which the ball breaks have all the ſame kind of electricity, it is evident that they muſt for that reaſon repel one another; and this repulſion is ſo ſtrong, that a man may be interpoſed within the ſtroke of two of them, without being hurt by either.

35 Why it ſometimes marks bodies with the form of a croſs.

The other effect of lightning is mentioned under the article Jerusalem, where thoſe who attempted to rebuild the temple had the marks of croſſes impreſſed upon their garments and bodies. This may reaſonably be thought to ariſe from the ſame cauſe to which the angular appearance of lightning in the air is owing, namely, its violent impetus and velocity, together with the oppoſition of the atmoſphere. A ſmall ſtroke of lightning, ſometimes indeed a very conſiderable one, cannot always enter the ſubſtance of terreſtial bodies, even when it touches them, for reaſons already given. In this caſe it runs along their ſurface, and, as in its motion it is perpetually reſiſted by the atmoſphere, it undoubtedly has the ſame angular motion which we often perceive in the atmoſphere. If in this ſituation it happens to touch the human ſkin, or a garment, eſpecially of linen, as being a conductor, it will undoubtedly leave a mark upon it; and this mark being of a zig-zag form, might, in the above inſtance, have been either taken for the exact form of a croſs by the beholders, or have ſuggeſted that idea in relating the ſtory to make it appear more wonderful.

Theſe obſervations may ſerve to give ſome idea of the nature of lightning, and its operations after it appears in its proper form and burſts out from the cloud; but for an account of its original formation, and of the powers by which the clouds are at firſt electrified, and their electricity kept up notwithſtanding many ſucceſſive diſcharges of lightning, and the quantity of electric matter continually carried off by the rain, &c. ſee the article THUNDER.

Artificial LIGHTNING. Before the diſcoveries of Dr Franklin concerning the identity of electricity and lightning, many contrivances were invented in order to repreſent this terrifying phenomenon in miniature: the coruſcations of phoſphorus in warm weather, the accenſion of the vapour of ſpirit of wine evaporated in a cloſe place, &c. were uſed in order to ſupport the hypotheſis which at that time prevailed; namely, that lightning was formed of ſome ſulphureous, nitrous, or other combuſtible vapours floating in long trains in the atmoſphere, which by ſome unaccountable means took fire, and produced all the deſtructive effects of that phenomenon. Theſe repreſentations, however, are now no more exhibited; and the only true artificial lightning is univerſally acknowledged to be the diſcharge of electric matter from bodies in which it is artificially ſet in motion by our machines.

LIGHTNING was looked upon as ſacred both by the Greeks and Romans, and was ſuppoſed to be ſent to execute vengeance on the earth: Hence perſons killed with lightning, being thought hateful to the gods, were buried apart by themſelves, leſt the aſhes of other men ſhould receive pollution from them. Some ſay they were interred upon the very ſpot where they died: others will have it that they had no interment, but were ſuffered to rot where they fell, becauſe it was unlawful for any man to approach the place. For this reaſon the ground was hedged in, leſt any perſon unawares ſhould contract pollution from it. All places ſtruck with lightning were carefully avoided and fenced round, out of an opinion that Jupiter had either taken offence at them, and fixed upon them the marks of his diſpleaſure, or that he had, by this means, pitched upon them as ſacred to himſelf. The ground thus fenced about was called by the Romans *bidentul*. Lightning was much obſerved in augury, and was a good or bad omen, according to the circumſtances attending it.

LIGNICENCIS TERRA, in the materia medica, the name of a fine yellow bole dug in many parts of Germany, particularly about Emeric in the circle of Weſtphalia, and uſed in cordial and aſtringent complaints.

LIGNUM VITÆ. See GUAIACUM.

LIGNUM *Aloes*. See EXCOECARIA.

LIGNUM *Nephriticum*. See GUILANDINA.

LIGNUM *Rhodium*, or *Roſewood*, in the materia medica; a wood, or root, chiefly brought to us from the Canary iſlands. The writers on botany and the materia medica are much divided about the lignum rhodium, not only with regard to the plant which affords it, but likewiſe in their accounts of the drug itſelf, and have deſcribed, under this name, ſimples manifeſtly different. This confuſion ſeems to have riſen from an opinion, that the *rhodium*, and the *aſpalathus* (an article of conſiderable eſteem among the ancients, but with regard to which the moderns are very much at a loſs), are the ſame; whence different woods brought into Europe for the unknown aſpalathus, were ſold again by the name of *rhodium*.

In thoſe modern pharmacopœias which admit the lignum rhodium, different Linnæan names are at preſent given to it: thus the authors of the Diſpenſatorium Brunſvicenſe ſuppoſe it to be the *Rhodiola roſa* of Linnæus; and thoſe of the Pharmacopœia Roſſica, the *Geniſta Canarienſis*. As to *Aſpalathus*, the ancients themſelves diſagree; Dioſcorides meaning by this appellation the wood of a certain ſhrub freed from the bark, and Galen the bark of a root. At preſent we have nothing under this name in the ſhops. What was heretofore ſold among us as aſpalathus, were pieces of a pale-coloured wood brought from the Eaſt Indies, and more commonly called *calambour*.

The aſpalathus, calambour, and lignum aquilæ, are ſuppoſed to be woods of the nature of agallochum, or lignum aloes, but weaker in quality. The lignum rhodium of the ſhops is uſually in long crooked pieces, full of knots, which when cut appear of a yellow colour like box, with a reddiſh caſt: the largeſt, ſmootheſt, moſt compact, and deepeſt coloured pieces, ſhould be choſen: and the ſmall, thin, or pale ones, rejected. The taſte of this wood is lightly bitteriſh, and ſomewhat pungent; its ſmell is very fragrant, reſembling that of roſes: long kept, it ſeems to loſe its ſmell; but on cutting, or rubbing one piece againſt the other, it ſmells as well as at firſt. Diſtilled with water, it yields an odoriferous eſſential oil, in very ſmall quantity. Rhodium is at preſent in eſteem only upon account of its oil, which is employed as an high and agreeable perfume in ſcenting pomatums and the like. But if we may reaſon from analogy, this odoriferous ſimple might be advantageouſly applied to more uſeful purpoſes; a tincture of it in rectified ſpirit of wine, which contains in ſmall volume the virtue of a conſiderable deal of the wood, bids fair to prove a ſerviceable cordial, not inferior perhaps to any thing of this kind.

LIGNUM *Campechenſe*. See HEMATOXILUM.

LIGNUM *Colubrinum*. See OPHIORHIZA.

LIGULATED, among botaniſts, an appellation, given to ſuch floſcules as have a ſtraight end turned downwards, with three indentures, but not ſeparated into ſegments.

LIGURIA (anc. geog.), a country of Italy, bounded on the ſouth by the Mediterranean ſea, on the north by the Appennine mountains, on the weſt by part of Tranſalpine Gaul, and on the eaſt by Etruria. There is a great diſagreement among authors concerning the origin of the Ligurians, though moſt probably they were deſcended from the Gauls. Some carry up their origin as far as the fabulous heroes of antiquity; while others trace them from the Ligyes, a people mentioned by Herodotus as attending Xerxes in his expeditions againſt Greece. Theſe Ligyes are by ſome ancient geographers placed in Colchis; by others, in Albania.—According to Diodorus Siculus, the Ligurians led a very wretched life; their country being entirely overgrown with woods, which they were obliged to pull up by the root, in order to cultivate their land, which was alſo encumbered with great ſtones, and, being naturally barren, made but very poor returns for all their labour. They were much addicted to hunting; and by a life of continual exerciſe and labour, became ſo ſtrong, that the weakeſt Ligurian was generally an overmatch for the ſtrongeſt and moſt robuſt among the Gauls. The women are ſaid to have been almoſt as ſtrong as the men, and to have borne an equal ſhare in all laborious enterpriſes. With all their bravery, however, they were not able to reſiſt the Roman power; but were ſubdued by that warlike nation, about 211 B. C.

LIGUSTICUM, LOVAGE, in botany: A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The fruit is oblong and quinqueſulcated on each ſide; the florets are equal; the petals involuted or rolled inwards, and entire. There are ſeven ſpecies; of which the moſt remarkable are, the leviſticum or common, and the ſcoticum or Scots, lovage. The firſt is a native of the Apennine mountains in Italy. It has a thick fleſhy, deeply-penetrating perennial root, crowned by very large, many-parted, radical leaves, with broad lobes, having inciſions at top, upright, ſtrong, channelled ſtalks, branching ſix or ſeven feet high, and all the branches terminated by yellow flowers in large umbels. The ſecond is a native of Scotland, and grows near the ſea in various parts of the country. It has a thickiſh, fleſhy, penetrating, perennial root, crowned by large doubly-trifoliated leaves, with broad, ſhort, indented lobes, upright round ſtalks, half a yard high, terminated by ſmall yellow umbels. Both ſpecies are hardy, and eaſily propagated by ſeeds ſown in ſpring or autumn.

Medicinal uſes, &c. The root of the firſt ſpecies agrees nearly in quality with that of angelica: the principal difference is, that the lovage root has a ſtronger ſmell, and a ſomewhat leſs pungent taſte, accompanied with a more durable ſweetneſs, the ſeeds being rather warmer than the root; but although certainly capable of being applied to uſeful purpoſes, this root is not regarded in the preſent practice. The leaves of the ſecond are ſometimes eaten raw as a ſallad, or boiled as greens by the inhabitants of the Hebrides. The root is reckoned a good carminative. They give an infuſion of the leaves in whey to their calves to purge them.

LIGUSTRUM, PRIVET, in botany: a genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 44th order, *Sepiariæ*. The corolla is quadrifid; the berry tetraſpermous. There is but one ſpecies; of which there are two varieties, the deciduous and the evergreen. They are hardy plants, riſing from 10 to 15 feet high, adorned with oblong entire leaves, and ſpikes of infundibuliform oblong white flowers, ſucceeded by black-berries. They are eaſily propagated by ſeed, layers, ſuckers, or cuttings. They are uſed for making hedges. The purple colour upon cards is prepared from the berries. With the addition of alum, theſe berries are ſaid to dye wool and ſilk of a good and durable green; for which purpoſe they muſt be gathered as ſoon as they are ripe. The leaves are bitter and ſlightly aſtringent. Oxen, goats and ſheep, eat the plant; horſes refuſe it.

LILBURNE (John), an enthuſiaſtic demagogue, who was tyrannically puniſhed by the ſtar-chamber court, being put in the pillory, whipped, fined, and impriſoned, for importing and publiſhing ſeditious pamphlets, which he had got printed in Holland; they chiefly reflected on the church of England and its biſhops: he ſuffered in 1637, and in priſon was doubly loaded with irons. In 1641, he was releaſed by the long parliament: and from this time, he had the addreſs to make himſelf formidable to all parties, by his bold aſpiring genius. He ſignaliſed himſelf in the parliament army; and was at one time the ſecret friend and confident of Cromwell, and at another his avowed enemy and accuſer; ſo that, in 1650, Cromwell found it to be his intereſt to ſilence him, by a grant of ſome forfeited eſtates. But after this, he grew outrageous againſt the protector's government; became chief of the levellers; and was twice tried for high treaſon, but acquitted by the juries. The laſt was for returning from exile (having been baniſhed by the parliament) without a paſs. He died in 1657, aged 88.

LILIACEOUS, in botany, an appellation given to ſuch flowers as reſemble thoſe of the lily.

LILIUM, the LILY, in botany: a genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 10th order, *Coronariæ*. The corolla is hexapetalous, and campanulated, with a longitudinal nectariferous line or furrow; the capſules connected by ſmall cancellated hairs. There are many ſpecies; all of them bulbous-rooted, herbaceous, flowery perennials, riſing with erect annual ſtalks three or four feet high, garniſhed with long narrow leaves, and terminated by fine cluſters of large bell-ſhaped, hexapetalous flowers of exceeding great beauty, of white, red, ſcarlet, orange, purple, and yellow colours.

Culture. All the ſpecies are propagated by ſowing the ſeeds; and if care is taken to preſerve theſe ſeeds from good flowers, very beautiful varieties are often produced. The manner of ſowing them is as follows. Some ſquare boxes ſhould be procured, about ſix inches deep, with holes bored in the bottoms to let out the wet,: theſe muſt be filled with freſh, light, ſandy earth; and the ſeeds ſown upon them pretty thick in the beginning of Auguſt, and covered over about half an inch deep with light ſifted earth of the ſame kind. They ſhould then be placed where they may have the morning ſun; and if the weather proves dry, they muſt be watered at times, and the weeds carefully picked out. In the month of October the boxes are to be removed to a place where they may have as much ſun as poſſible, and be ſecured from the north and north-eaſt winds. In ſpring the young plants will appear, and the boxes are then to be removed into their former ſituation. In Auguſt the ſmalleſt roots are to be emptied out of theſe boxes, and ſtrewed over a bed of light earth, and covered with about half an inch depth of earth of the ſame kind, ſifted over them. Here they muſt be watered, and ſhaded at times, and defended from the ſeverity of winter by a ſlight covering of ſtraw or peaſe-haulm in the hardeſt weather. In

February, the ſurface of the bed ſhould be cleared, and a little light earth ſifted over it. When the leaves are decayed, the earth ſhould be a little ſtirred over the roots; and in the month of September following ſome more earth ſifted on. In the September of the following year, the roots muſt be tranſplanted to the places where they are to remain, and ſet at the diſtance of eight inches; the roots being placed four inches below the ſurface: this ſhould be done in moiſt weather. They will now require the ſame care as in the preceding winter; and, the ſecond year after they are tranſplanted, the ſtrongeſt roots will begin to flower. The fine ones ſhould then be removed at the proper ſeaſon into flower beds, and planted at great diſtances from one another that they may flower ſtrong.

Medical uſes. The roots of the white lily are emollient, maturating, and greatly ſuppurative. They are uſed externally in cataplaſms for theſe purpoſes with ſucceſs. The common form of applying them is boiled and bruiſed; but ſome prefer the roaſting them till tender, and then beating them to a paſte with oil, in which form they are ſaid to be excellent againſt burns. Gerard recommends them internally againſt dropſies.

The Kamtſchatence, or Kamtſchatka lily, called there *ſaranne*, makes a principal part of the food of the Kamtſchatkans. Its roots are gathered by the women in Auguſt, dried in the ſun, and laid up for uſe: they are the beſt bread of the country; and after being baked are reduced to powder, and ſerve inſtead of flour in ſoups and ſeveral diſhes. They are ſometimes waſhed, and eaten as potatoes; are extremely nouriſhing, and have a pleaſant bitter taſte. Our navigators boiled and eat them with their meat. The natives often parboil, and beat it up with ſeveral ſorts of berries, ſo as to form of it a very agreeable confection. Providentially it is an univerſal plant there, and all the grounds bloom with its flower during the ſeaſon. Another happineſs, remarked there is, that while fiſh are ſcarce the ſaranne is plentiful; and when there is a dearth of this, the rivers pour in their proviſions in redoubled profuſion. It is not to the labours of the females alone that the Kamtſchatkans are indebted for theſe roots. A ſpecies of mouſe ſaves them a great deal of trouble. The ſaranne forms part of the winter proviſions of that little animal: they not only gather them in the proper ſeaſon, and lay them up in their magazines, but at times have the inſtinct of bringing them out in ſunny weather to dry them, leſt they ſhould decay. The natives ſearch for their hoards; but with prudent tenderneſs leave part for the owners, being unwilling to ſuffer ſuch uſeful caterers to periſh.

LILLO (George), an excellent dramatic writer, born at London in 1693. He was a jeweller by profeſſion, and followed his buſineſs for many years in that neighbourhood with the faireſt reputation. He was at the ſame time ſtrongly attached to the muſes, yet ſeemed to have laid it down as a maxim, that the devotion paid to them ought always to tend to the promotion of virtue, morality, and religion. In purſuance of this aim, Lillo was happy in the choice of his ſubjects, and ſhowed great power of affecting the heart, by working up the paſſions to ſuch a height, as to render the diſtreſſes of common and domeſtic life equally intereſting to the audiences as that of kings and heroes, and the ruin brought on private families by an indulgeuce of avarice, luſt, &c. as the havock made in ſtates and empires by ambition, cruelty, or tyranny. His “George Barnwell,” “Fatal Curioſity,” and “Arden of Feverſham,” are all planned on common and well-known ſtories; yet they have perhaps more frequently drawn tears from an audience than the more pompous tragedies of Alexander the Great, All for Love, &c. In the prologue to “Elmeric,” which was not acted till after the author's death, it is ſaid, that when he wrote that play, he “was depreſſed by want,” and afflicted by diſeaſe; but in the former particular there appears to be evidently a miſtake, as he died poſſeſſed of an eſtate of L.60 a-year, beſides other effects to a conſiderable value. His death happened in 1739, in the 47th year of his age. His works have been lately collected, and publiſhed, with an account of his life, in 2 vols 12mo. by Mr T. Davis.

LILLY (John), a dramatic poet, was born in the wilds of Kent, about the year 1553, and educated in Magdalen-college, Oxford, where he took the degree of bachelor of arts in 1573, and that of maſter in 1575. From Oxford he removed to Cambridge; but how long he continued there, is uncertain. On his arrival in London, he became acquainted with ſome of Queen Elizabeth's courtiers, by whom he was careſſed, and admired as a poet and a wit; and her majeſty, on particular feſtivals, honoured his dramatic pieces with her preſence. His plays are nine in number. His firſt publication, however, printed in 1580, was a romance called *Euphues*, which was univerſally read and admired. This romance, which Blount, the editor of ſix of his plays, ſays introduced a new language, eſpecially among the ladies, is, according to Berkenhout, in fact a moſt contemptible piece of affectation and nonſenſe: nevertheleſs it ſeems very certain, that it was in high eſtimation by the women of faſhion of thoſe times, who, we are told by Whalley the editor of Ben Johnſon's works, had all the phraſes by heart; and thoſe who did not ſpeak *Euphuiſm* were as little regarded at court as if they could not ſpeak French. “He was (ſays Oldys) a man of great reading, good memory, ready faculty of application, and uncommon eloquence; but he ran into a vaſt exceſs of alluſion.” When or where he died is not known. Anthony Wood ſays he was living in 1597, when his laſt comedy was publiſhed. After attending the court of Queen Elizabeth 13 years, notwithſtanding his reputation as an author, he was under a neceſſity of petitioning the queen for ſome ſmall ſtipend to ſupport him in his old age. His two letters or petitions to her majeſty on this ſubject are preſerved in manuſcript.

LILLY (William), a noted Engliſh aſtrologer, born in Leiceſterſhire in 1602; where his father not being able to give him more learning than common writing and arithmetic, he reſolved to ſeek his fortune in London. He arrived in 1620, and lived four years as a ſervant to a mantua-maker in the pariſh of St Clements Danes; but then moved a ſtep higher to the ſervice of Mr Wright, maſter of the Salter's company in the Strand, who not being able to write, Lilly among other offices kept his books. In 1627, when his maſter died, he paid his addreſſes to the widow, whom he married with a fortune of 1000l. Being now his own maſter, he followed the puritanical preachers; and, turning his mind to judicial aſtrology, became pupil to one Evans, a profligate Welſh parſon, in that pretended art. Getting a MS. of the *Ars notitia* of Corn. Agrippa, with alterations, he drank in the doctrine of the magic circle, and the invocation of ſpirits, with great eagerneſs. He was the author of the *Merlinus Anglicus junior; The Supernatural Sight*; and *The White King's Prophecy*. In him we have an inſtance of the general ſuperſtition and ignorance that prevailed in the time of the civil war between Char. I. and his parliament: for the king conſulted this aſtrologer, to know in what quarter he ſhould conceal himſelf if he could eſcape from Hampton court; and general Fairfax, on the other ſide, ſent for him to his army, to aſk him if he could tell by his art whether God was with them and their cauſe? Lilly, who made his fortune by favourable predictions to both parties, aſſured the general that God would be with him and his army. In 1648, he publiſhed his *Treatiſe of the three Suns* ſeen the preceding winter; and alſo an aſtrological judgment upon a conjunction of Saturn and Mars. This year the council of ſtate gave him in money 50l. and a penſion of 100l. *per annum*, which he received for two years, and then reſigned on ſome diſguſt. In June 1660, he was taken into cuſtody by order of the parliament, by whom he was examined concerning the perſon who cut off the head of king Charles I. The ſame year he ſued out his pardon under the great ſeal of England. The plague raging in London, he removed with his family to his eſtate at Herſham; and in October 1666 was examined before a committee of the houſe of commons concerning the fire of London, which happened in September that year. After his retirement to Herſham, he applied himſelf to the ſtudy of phyſic, and by means of his friend Mr Aſhmole, obtained from archbiſhop Sheldon a licence for the practice of it. A little before his death he adopted for his ſon, by the name of *Merlin junior*, one Henry Coley, a taylor by trade; and at the ſame time gave him the impreſſion of his almanac, after it had been printed for 36 years. He died in 1681 of a dead palſy. Mr Aſhmole ſet a monument over his grave in the church of Walton upon Thames. His "Obſervations on the Life and Death of Charles late King of England," if we overlook the aſtrological nonſenſe, may be read with as much ſatisfaction as more celebrated hiſtories; Lilly being not only very well informed, but ſtrictly impartial. This work, with the Lives of Lilly and Aſhmole, written by themſelves, were publiſhed in one vol. 8vo. in 1774, by Mr Burman.

LILLY, in botany. See Lilium.

Lilly of the Valey. See Convallaria.

LILYBÆUM (anc. geog.), a city of Sicily, ſituated on the moſt weſterly promontory of the iſland of Sicily, and ſaid to have been founded by the Carthaginians on their expulſion from Motya by Dionyſius tyrant of Syracuſe. It is remarkable for three ſieges it ſuſtained; one againſt Dionyſius the tyrant, another againſt Pyrrhus king of Epirus, and the third againſt the Romans. The two firſt failed in their attempts, but the Romans with great difficulty made themſelves maſters of it. No remains of this once ſtately city are now to be ſeen, except ſome aqueducts and temples; though it was ſtanding in Strabo's time.

LILYE (William,) the grammarian, was born in the year 1466 at Oldham in Hampſhire; and in 1486, was admitted a ſemi-commoner of Magdalen college, in Oxford. Having taken the degree of bachelor of arts, he left the univerſity and travelled to Jeruſalem. Returning from thence, he continued five years in the iſland of Rhodes, where he ſtudied the Greek language, ſeveral learned men having retired thither after the taking of Conſtantinople. From Rhodes he travelled to Rome; where he improved himſelf in the Greek and Latin languages, under Sulpitius and P. Sabinus. He then returned to London, where for ſome time he taught a private grammar-ſchool, being the firſt perſon who taught Greek in the metropolis. In 1510, when Dr Colet founded St Paul's ſchool, Lilye was appointed the firſt maſter; at which time, it ſeems, he was married and had many children. In this employment he had laboured 12 years, when, being ſeized by the plague, which then raged in London, he died in February 1523, and was buried in the north yard of St Paul's. He had the character of an excellent grammarian, and a ſucceſsful teacher of the learned languages. His principal work is *Breviſſima inſtitutio, ſeu ratio grammatices cognoſcendæ*; Lond. 1513. Reprinted times without number, and commonly called *Lilye's grammar*. The Engliſh rudiments were written by Dr Colet, dean of St Paul's; and the preface to the firſt edition, by cardinal Wolſey. The Engliſh ſyntax was written by Lilye; alſo the rules for the genders of nouns, beginning with *Propria quæ maribus*: and thoſe for the preterperfect tenſes and ſupines, beginning with *As in preſenti*. The Latin ſyntax was chiefly the work of Eraſmus, See Ward's preface to his edition of Lilye's Grammar, 1732.

LIMA, a city of South-America, in Peru, of which it is capital, with an archbiſhop's ſee, and an univerſity. It gives its name to the principal audience of Peru; and is ſurrounded with brick-walls, fortified with ſeveral ramparts and baſtions, eight yards high. The ſtreets are handſome, and as ſtraight as a line; but the houſes are generally only one ſtory high, on account of the earthquakes. However, they are pretty enough, and well adorned, having long galleries on the front. One part of the roofs are covered with coarſe linen cloth, and other only with reeds, which is not inconvenient, becauſe it never rains here; however, the richeſt inhabitants cover theirs with fine mats or beautiful cotton-cloths. There are trees planted all round their houſes, to keep off the heat of the ſun. What the houſes want in height they have in length and depth; for ſome of them are 200 feet long, and proportionably broad, ſo that they have 10 or 12 large apartments on the ground-floor. The royal ſquare is very handſome, and in the middle there is a fountain of bronze, adorned with the image of Fame which ſpouts up water. On the eaſt and weſt ſides are the public ſtructures, which are well built. The river which croſſes Lima forms canals or ſtreams which run to moſt of the houſes, and ſerve to water their gardens, as well as for other uſes. All the churches and convents are extremely rich; and many images of the ſaints are of maſſy gold, adorned with jewels. This city is four miles in length, and two in breadth, and is divided into eight pariſhes; and yet it contains but 28,000 inhabitants, whereof 9000 are Spaniards. They make uſe of mules to draw their coaches with, and of theſe there are about 5000. It is the ſeat of the viceroy, and contains ſeveral courts; as that of the viceroy, of the archbiſhop, of the inquiſition, of the cruſado, and of the wills. Earthquakes are here very frequent; ſome of which have done this city a great deal of damage, particularly that in 1746, whereby it was almoſt deſtroyed: were it not for this, it would be a perfect paradiſe; there being plenty of corn, wine, oil, ſugar, fruits, and flax. The inhabitants are ſo rich, that when the viceroy, who was duke of Palata, and ſent from Spain to Peru in 1672, made his public entrance into this city, the inhabitants paved the ſtreets he was to paſs through with ingots of ſilver. The inhabitants of Lima are very debauched, but at the ſame time extremely ſuperſtitious, and they have a ſtrong belief in the power of charms. About a fourth part of the city are monks and nuns, who are not a jot more chaſte than the reſt; and if any one happens to rival a monk, he is in danger of his life, for they always carry a dagger under their frocks. The nuns are ſuch libertines, that it is hard to find any free from the French diſeaſe, of which they ſometimes die for want of good phyſicians. The greateſt ſinners think they atone for all their faults by hearing a maſs, and kiſſing the robe of St Francis or St Dominic, and then they return to their former practices. It is ſeated on a large, pleaſant, fertile plain, on a ſmall river near the ſea. W. Long. 68. 45. S. Lat. 12. 15.

Mariti's Travels through Cyprus.

LIMASSOL, or LIMISSO, a town of Cyprus, in the ſouth of the iſland. Of the ancient city nothing but ruins now remain; though it was a celebrated place, even under the government of the dukes. King Richard, the conqueror of the laſt of theſe vaſſals of the empire, razed it in 1191, and it was never afterwards rebuilt. This city originally was the ſame as AMATHUS or Amathonte; ſo famous, as Pauſanias tells us, for its temple erected in honour of Venus and Adonis. Amathus was the reſidence of the nine firſt kings of the iſland; and amongſt others of Oneliſtus, who was ſubjected afterwards by the arms of Artabanes, the Perſian general. This city, erected into an archbiſhopric in the time of the Chriſtians, has produced a number of perſonages celebrated for their knowledge and the ſanctity of their lives. In the neighbourhood there are ſeveral copper mines, which the Turks have been forced to abandon. The following lines, in the tenth book of Ovid's Metamorphoſes, prove that they were known in the time of that poet:

> Capta viri forma, non jam Cytherea curat
> Littora, non alto repetit Paphon æquore cinctam,
> Piſcoſamque Gnidon, gravidamque Amathunta metallis.

The place where the new Limaſſol now ſtands, formerly had the name of *Nemoſia*, from the multitude of woods by which it was ſurrounded. Richard king of England having deſtroyed Amathonte, Guy de Luſignan in the 12th century laid the foundations of that new city which the Greeks called *Neopoleos*. The family of Luſignan, who continued to embelliſh and fortify it, built there palaces, and Greek and Latin churches; and made it the ſeat of a biſhop. When the iſland was taken by the Turks in 1570, the Ottoman army entered the city on the 2d of July, and ravaged it without mercy. It was then deſtroyed by the flames; and at preſent it is only a wretched place, in which one can ſcarcely diſtinguiſh any remains of its ancient edifices. It is governed by a commiſſary and a cadi: the latter judges caſes only proviſionally, before they are carried to the ſuperior tribunal of Nicoſia. The harbour is very commodious; and being ſheltered from impetuous winds, it affords a ſafe and calm aſylum to veſſels when overtaken by a ſtorm. The carob tree is here more abundant than any where elſe; and it is from the port of Limaſſol that the greateſt quantity of its fruit is exported. The inhabitants export alſo ſalt, procured from a lake near Salines. Cotton, wheat, barley, and mulberry-trees, are both plentiful and well cultivated in this part of the iſland: the ground alſo produces all kinds of garden ſtuff. The beſt Cyprus wine is made from the vines that grow on the hills of Limaſſol. All the wines of the country are collected in this city to be tranſported to Larnic, where there are the largeſt cellars, and which on that account becomes the natural centre of commerce.

LIMAX, the SLUG, or *Naked Snail*; a genus of inſects belonging to the order of vermes molluſci. The body is oblong, fitted for crawling, with a kind of muſcular coat on the upper part; and the belly is plain. They have four tentacula, or horns, ſituated above the mouth, which they extend or retract at pleaſure. This reptile is always deſtitute of ſhell; but beſides that its ſkin is more clammy and of a greater conſiſtency than that of the ſnail, the black naked ſlug has a furrowed cloak, almoſt as thick and as hard as leather, under which it withdraws its head as within a ſhell. The head is diſtinguiſhed from the breaſt by a black line. It is in its head and back that the ſnail-ſtone is found; which is a ſmall pearled and ſandy ſtone, of the nature of lime ſtones: according to a popular opinion, it cures the tertian ague, if faſtened to the patient's arm. Theſe ſlugs move on ſlowly, leaving every where clammy and ſhining marks of their paſſage. Their coming together is about the end of ſpring. The organs of generation are placed, as in the ſnail, on the right ſide of the neck. The male implement unfolds with the ſame mechaniſm as the finger of a glove when turned inſide out. They are ſometimes met with hanging in the air with their heads downwards; and their tails, united by a kind of viſcous and thick tie, grappled to the branch of a tree. In this ſituation they remain for three hours, and that is the time of impregnation. They depoſit their eggs in the earth. There are eight ſpecies, diſtinguiſhed entirely by their colour; as the black ſlug, the white ſlug, the reddiſh ſlug, the aſh-coloured ſlug, &c. The black ſlug is hermaphrodite, both ſexes being in each individual, and in the coitus both impregnate and are impregnated at the ſame time.—A black ſlug powdered over with ſnuff, ſalt, or ſugar, falls into convulſions, caſts forth all its foam, and dies. See REPRODUCTION.

LIMB, in general, denotes the border or edge of a thing; thus we ſay, the limb of a quadrant, of the ſun, of a leaf, &c.

LIMB, in anatomy, an apellation given to the extremities of the body, as to the arms and legs.

LIMB, Limbus, in the church of Rome, is uſed in two different ſenſes. 1. The limb of the patriarchs is ſaid to be the place where the patriarchs waited the redemption of mankind: in this place they ſuppoſe our Saviour's ſoul continued from the time of his death to his reſurrection. 2. The limb of infants dying without baptiſm, is a place ſuppoſed to be diſtinct both from heaven and hell; ſince, ſay they, children dying innocent of any actual ſin, do not deſerve hell: and, by reaſon of their original ſin, cannot be admitted into heaven.

LIMBAT, the name of a periodical wind common in the iſland of Cyprus, and of great ſervice in moderating the heats of the climate, which would otherwiſe be intolerable.

According to the Abbé Mariti, it begins to blow at eight in the morning the firſt day; increaſes as the ſun advances till noon; then gradually weakens, and at three falls entirely. On the ſecond day it ariſes at the ſame hour; but it does not attain its greateſt ſtrength till about one in the afternoon, and ceaſes at four preciſely. On the third day it begins as before; but it falls an hour later. On the five ſucceeding days, it follows the ſame progreſſion as on the third; but it is remarked, that a little before it ceaſes, it becomes extremely violent. At the expiration of five days it commences a new period like the former. By narrowly obſerving the ſea on that ſide from which it is about to blow a little before it ariſes, one may determine what degree of ſtrength it will have during the day. If the horizon is clear, and entirely free from clouds, the wind will be weak, and even almoſt inſenſible; but if it is dark and cloudy, the wind will be ſtrong and violent. This limbat wind, notwithſtanding its utility in moderating exceſſive heat, often becomes the cauſe of fevers, eſpecially to the Europeans, from their being leſs habituated to the climate, more apt than the natives to ſuffer themſelves to be ſurpriſed by the cool air when in a ſtate of perſpiration. This wind, the falling of which happens an hour ſooner or later, is ſucceeded by a calm, accompanied by a certain moiſture that renders the air ſomewhat heavy. This moiſture diſappears in the evening, being diſſipated by a wind which ariſes every day at that period. This wind is conſidered as a land breeze by the inhabitants of the ſouthern and eaſtern parts of the iſland; but it is called *a ſea breeze* by thoſe in the northern and weſtern, who indeed receive it immediately from the ſea. In ſummer it blows till four o'clock in the morning and when it ceaſes, it leaves a profound calm, which continues till the hour when the limbat commences. In autumn and winter it never falls till day-break, when it is ſucceeded by other winds, which proceed from the irregularity of the ſeaſon. In ſpring it does not continue longer than midnight; and it is then ſucceeded by that happy calm, during which thoſe refreſhing dews are formed that moiſten the earth at ſun-riſing. The limbat winds, which ariſe in the beginning of ſummer, ceaſe about the middle of September; and this is the period when the moſt inſupportable heats commence, becauſe their violence is not moderated by the ſmalleſt breeze. They are, however, luckily not of long duration; and about the latter end of October they decreaſe ſenſibly, as the atmoſphere begins to be loaded with watery clouds.

LIMBORCH (Philip), a learned writer among the remonſtrants, born at Amſterdam in 1633. After having made great proficiency in his ſtudies, he was, in 1655, admitted to preach in public, which he did firſt at Haerlem. His ſermons had in them no affected eloquence; but were ſolid, methodical, and edifying. He was choſen miniſter of Goudja; from whence he was called to Amſterdam, where he had the profeſſorſhip of divinity, in which he acquitted himſelf with great reputation till his death which happened in 1712. He had an admirable genius, and a tenacious memory. He had many friends of diſtinction in foreign parts as well as in his own country. Some of his letters to Mr Locke are printed with thoſe of that celebrated author. He had all the qualifications ſuitable to the character of a ſincere divine, lived an example of every virtue, and preſerved the vigour of his body and mind to a conſiderable age. He wrote many works, which are eſteemed; the principal of which are, 1. *Amica collatio de veritate religionis Chriſtianæ cum erudito Judæo*, in 12mo. 2. A complete body of Divinity, according to the opinions and doctrines of the remonſtrants. 3. A hiſtory of the Inquiſition; which has been tranſlated into Engliſh by Dr Samuel Chandler. Limborch alſo publiſhed the works of the famous Epiſcopius, who was his great uncle by the mother's ſide.

LIMBURGH DUCHY, a province of the Auſtrian Netherlands, bounded by the duchy of Juliers on the north and eaſt, by Luxemburgh on the ſouth, and by the biſhopric of Liege on the weſt. It is about 30 miles in length, and 25 in breadth; and conſiſts of good arable and paſture land, with plenty of wood, and ſome iron mines.

LIMBURGH, the capital city of the duchy of Limburgh, in the Auſtrian Netherlands, is ſeated on a ſteep rock near the river Veſſe. This town is ſmall, but pleaſantly ſeated on a hill, with ſhady woods; and conſiſts chiefly of one broad ſtreet, not very well built. It is ſtrong by ſituation, and almoſt inacceſſible; however, it was taken by the French in 1675, and by the confederates under the duke of Marlborough in 1703, for the houſe of Auſtria, to whom it remains by the treaties of Raſtadt and Baden, after having been diſmantled. It is famous for its cheeſe, which is exceedingly good. E. Long. 6. 8. N. Lat. 50. 40.

LIME. See QUICKLIME.

LIME-Tree. See CITRUS.

LIME or *LINDEN-Tree.* See TILIA.

LIME-Water. See PHARMACY-*Index*.

LIME, or *Lyme.* See LYME.

LIMERICK, a county of Ireland, in the province of Munſter, is bounded on the eaſt by Tipperary, on the weſt by Kerry, on the north by the river Shannon, and on the ſouth by Cork. It is a fruitful and populous tract, the ſoil requiring little or no manure in moſt places: beſides rich paſture for ſheep and cows, it produces rich crops of all kinds of corn and rape, with ſome hemp. It gave title of earl to the family of Dongan. It contains 375,320 Iriſh plantation acres, about fifty-ſix church livings, though a much greater number of pariſhes, ten baronies, three boroughs, and ſends eight members to parliament. It has ſome clays, furze, fern, and mountain lands, and is famous for good cyder; it has been much benefited by the palatines, who ſettled there and increaſed tillage; they are a laborious independent people, moſtly employed in their own farms. This country is well watered by large and ſmall rivers; the Shannon runs at the north ſide of the county, and fertilizes its banks. The fuel of the inhabitants is chiefly turf, and the bogs are conveniently ſituated. At Loghill in the weſt of the county, there is a mine of coal or culm, but it is more uſed in kilns than in houſes. There are few lakes except Lough Gur: and the principal hills are Knockgreny, Knockany, Knockfiring, and Tory-hill. The mountains lie weſtward, the higheſt being Knockpatrick or St. Patrick's hill. This county is about 45 miles long and 42 broad.

LIMERICK, or *Lough-Meath*, a market-town, a borough, and a biſhop's ſee, now the metropolis of the province of Munſter. It is ſituated on the river Shannon, 94 miles from Dublin; and was the ſtrongeſt fortreſs in the kingdom. Its ancient name was Lunneach; and during the firſt ages it was much frequented by foreign merchants, and after the arrival of the Danes was a place of conſiderable commerce until the 12th century. It was plundered by Mahon, brother of Brien Boromh, after the battle of Sulchoid, in 970; and Brien, in a future period, exacted from the Danes of this city 365 tons of wine as a tribute which ſhows the extenſive traffic carried on by thoſe people in that article. About the middle of the 6th century, St Munchin erected a church and founded a biſhopric here; which, however, was deſtroyed by the Danes on their taking poſſeſſion of this port in 853, and remained in ruins until their converſion to the Chriſtian faith in the 10th century; at which period the church of Munchin was rebuilt, and the biſhopric eſtabliſhed. Donald O'Brien, about the time of the arrival of the Engliſh, founded and endowed the cathedral; and Donat O'Brien, biſhop of Limerick, in the 13th century, contributed much to the opulence of the ſee. About the cloſe of the 12th century, the biſhopric of Innis-Cathay was united to that of Limerick. It was beſieged by king William III. in the year 1690; and though there was no army to aſſiſt it, the king was obliged to raiſe the ſiege. In the year 1691, it was again beſieged by the Engliſh and Dutch on the 21ſt of September; and it was obliged to ſurrender on the 13th of October following, not without the loſs of abundance of men: however, the garriſon had very honourable and advantageous conditions, being permitted to retire where they thought fit, and the Roman-catholics by theſe articles were to be tolerated in the free exerciſe of their religion. Within a century this place was reckoned the ſecond city in Ireland; at preſent it has loſt its rank; not becauſe it thrives leſs, but becauſe Cork thrives more. It is compoſed of the Iriſh and Engliſh town; the latter ſtands on the King's iſland, formed by the river Shannon. The town is three miles in circumference, having weekly markets on Wedneſday and Saturday, and fairs on Eaſter Tueſday, 1ſt July, 4th Auguſt, and 12th December. There is a privilege annexed to the fair held on 4th Auguſt, that, during 15 days, no perſon can be arreſted in the city or liberties, on any proceſs iſſuing out of the Tholſel court of Limerick. Ardfert and Achadoe, in the county of Kerry, are united to the biſhopric of Limerick. This city returns two members to parliament; and gives title of viſcount to the family of Hamilton. It is governed by a mayor, ſheriffs, recorder, aldermen, and burgeſſes; there is alſo a barrack and a military governor and town-major: it had ſome time the privilege of coinage; and different parliaments have been held there. The town was formerly entirely walled in; and in 1760, there were 17 of the city gates ſtanding; but to the great improvement of the place they are now all demoliſhed, except the water-gate of king John's caſtle. The linen, woollen, and paper manufactures are carried on here to great extent, and the export of proviſions is very conſiderable. Here are many charitable hoſpitals and handſome public buildings, beſides the cathedral and other churches. A charter was granted to this city by king John, and confirmed in ſucceeding reigns. Dr Campbell obſerves, that as you approach Limerick, the grounds grow rich and exquiſitely beautiful; the only diſagreeable matter is, that the ſituation renders the air moiſt, and conſequently rather unwholeſome to ſtrangers. About ſix miles from this is the famous Caſtle-connel-ſpa. Limerick is 50 miles from Cork, 50 from Galway, and 73 from Waterford. It appears that Limerick obtained the privilege of having mayors 10 years before that right was allowed to the citizens of London. It was before governed by provoſts, of which the firſt was John Spafford, in 1195 and 1197; during the provoſtſhip of Henry Troy a charter was granted, 9 Richard I, whereby the citizens were allowed to chooſe mayors and bailiffs, Adam Servant, in 1198, being the firſt mayor. It continued to be governed by mayors and bailiffs, until the office of bailiff was changed into that of ſheriff, in 1609.

LIMERICK is alſo the name of a fair town in the county of Wexford and province of Leinſter; the fairs are four in the year.

LIMINGTON, a town of Hampſhire in England. See LYMINGTON.

LIMIT, in a reſtrained ſenſe, is uſed by mathematicians for a determined quantity to which a variable one continually approaches; in which ſenſe the circle may be ſaid to be the limit of its circumſcribed and inſcribed polygons. In Algebra, the term *limit* is applied to two quantities, one of which is greater and the other leſs than another quantity; and in this ſenſe it is uſed in ſpeaking of the limits of equations, whereby their ſolution is much facilitated.

LIMME, a town of Kent, in England, near Hithe, and four miles from Romney, was formerly a port, till choaked up by the ſands; and though it is thereby become a poor town, yet it has the horn and mace and other tokens left of its ancient grandeur, and uſed to be the place where the lord warden of the cinque-ports was ſworn at his entrance upon his office. The Roman road from Canterbury, called *Stane-ſtreet*, ended here; and from the brow of its hill may be ſeen the ruinous Roman walls almoſt at the bottom of the marſhes. Here formerly was a caſtle, now converted into a farm-houſe. When or by whom this edifice was erected is not known. It has, however, great marks of antiquity; as has alſo the adjoining church, in which are ſeveral old tombſtones with croſſes on them.

LIMNING, the art of painting in water-colours, in contradiſtinction to painting which is done in oil-colours.

Limning is much the more ancient kind of painting. Till a Flemiſh painter, one John van Eyck, better known by the name of *John of Bruges*, found out the art of painting in oil, the painters all painted in water and in freſco, both on their walls, on wooden boards, and elſewhere. When they made uſe of boards, they uſually glued a fine linen cloth over them, to prevent their opening; then laid on a ground of white; laſtly, they mixed up their colours with water and ſize, or with water and yolks of eggs, well beaten with the branches of a fig-tree, the juice whereof thus mixed with the eggs; and with this mixture they painted their pieces.

In limning, all colours are proper enough, except the white made of lime, which is only uſed in freſco. The azure and ultramarine muſt always be mixed with ſize or gum; but there are always applied two layers of hot ſize before the ſize-colours are laid on: the colours are all ground in water each by itſelf; and, as they are required in working, are diluted with ſize-water. When the piece is finiſhed, they go over it with the white of an egg well beaten; and then with varniſh, if required.

To limn, or draw a face in colours: Having all the materials in readineſs, lay the prepared colour on the card even and thin, free from hairs and ſpots over the place where the picture is to be. The ground being laid, and the party placed in a due poſition, begin the work, which is to be done at three ſittings. At the firſt you are only to dead colour the face, which will require about two hours. At the ſecond ſitting, go over the work more curiouſly, adding its particular graces or deformities. At the third ſitting, finiſh the whole; carefully remarking whatever may conduce to render the piece perfect, as the caſt of the eyes, moles, ſcars, geſtures, and the like.

LIMOGES, an ancient and conſiderable town of France, in the province of Guienne, and capital of Limoſin, with a biſhop's ſee. It is a trading place, and its horſes are in great eſteem. It is ſeated on the river Vienne, in E. Long. 1. 22. N. Lat. 42. 48.

LIMOSIN, a province of France, bounded on the north by La Marche, on the eaſt by Auvergne, on the ſouth by Quercy, and on the weſt by Perigord and Angoumois. It is divided into the Upper and Lower; the former of which is very cold, but the latter more temperate. It is covered with foreſts of cheſnut-trees; and contains mines of lead, copper, tin, and iron; but the principal trade conſiſts in cattle and horſes.

LIMPET. See PATELLA.

LIMPURG, a barony of Germany, in the circle of Franconia, included almoſt entirely within Suabia, and ſeated to the ſouth of Hall in Suabia. It is about 15 miles long, and eight broad. Gaildorf and Shonburg, near which is the caſtle of Limpurg, are the principal places.

LIMPURG, a town of Germany, in the electorate of Triers or Treves, and in Wetteravia, formerly free and imperial, but now ſubject to the electorate of Treves. It is ſeated on the river Lhon. E. Long. 8. 13. N. Lat. 50. 18.

LINARIA, in ornithology. See FRINGILLA.

LINACRE (Thomas), phyſician, was born at Canterbury about the year 1460, and there educated under the learned William Selling: thence he removed to Oxford, and in 1484 was choſen fellow of All-Souls college. Tilly, *alias* Selling, his former inſtructor, being at this time appointed ambaſſador from King Henry VII. to the court of Rome, Mr Linacre accompanied him to Italy, where he attained the higheſt degree of perfection in the Greek and Latin languages. At Rome, he applied himſelf particularly to the ſtudy of Ariſtotle and Galen, in the original. On his return to Oxford, he was incorporated doctor of phyſic, and choſen public profeſſor in that faculty. But he had not been long in England, before he was commanded to court by King Henry VII. to attend the young Prince Arthur as his tutor and phyſician. He was afterwards appointed phyſician to the king, and, after his death, to his ſucceſſor Henry VIII. Dr Linacre founded two medical lectures at Oxford, and one at Cambridge; but that which moſt effectually immortalized his name among the faculty, is his being the firſt founder of the college of phyſicians in London. He beheld with vexation the wretched ſtate of phyſic in thoſe times; and, by an application to Cardinal Wolſey, obtained a patent in 1518, by which the phyſicians of London were incorporated. The intention of this corporation was to prevent illiterate and ignorant medicaſters from practiſing the art of healing. Dr Linacre was the firſt preſident, and held the office as long as he lived. Their meetings were in his own houſe in Knight-rider ſtreet which houſe he bequeathed to the college. But our doctor, when he was about the age of 50, took it into his head to ſtudy divinity; entered into orders; and was collated, in 1509, to the rectory of Merſham. In the ſame year he was inſtalled prebendary of Wells, in 1518 prebendary of York, and in the following year was admitted precentor of that cathedral. This, we are told, he reſigned for other preferments. He died of the ſtone in the bladder in October 1524, aged 64; and was buried in St. Paul's. Thirty-three years after his death, Doctor John Caius cauſed a monument to be erected to his memory, with a Latin inſcription, which contains the outlines of his life and character. He was a man of great natural ſagacity, a ſkilful phyſician, a profound grammarian, and one of the beſt Greek and Latin ſcholars of his time. Eraſmus in his epiſtles ſpeaks highly of the doctor's tranſlations from Galen, preferring them even to the original Greek. His works are, 1. *De emendata ſtructura Latini ſermonis, libri ſex;* London, printed by Pynſon, 1524, 8vo, and by Stephens, 1527, 1532. 2. The rudiments of grammar, for the uſe of the princeſs Mary, printed by Pynſon. Buchanan tranſlated it into Latin; Paris, 1536. He likewiſe tranſlated into very elegant Latin, ſeveral of Galen's works, which were printed chiefly abroad at different times. Alſo *Procli Diadochi ſphera*, tranſlated from the Greek; Venet. 1499, 1500.

LINCOLN, a city of England, and capital of a county of the ſame name, is diſtant 132 miles from London. It ſtands on the ſide of a hill; at the bottom of which runs the river Withum in three ſmall channels, over which are ſeveral bridges. The old *Lindum* of the Britons, which ſtood on the top of the hill, as appears from the veſtiges of a rampart, and deep ditches ſtill remaining, was taken and demoliſhed by the Saxons; who built a town upon the ſouth ſide of the hill down to the river ſide, which was ſeveral times taken by the Danes, and as often retaken by the Saxons. In Edward the Confeſſor's time, it appears, from Doomſday-book, to have been a very conſiderable place; and in the time of the Normans, Malmſbury, ſays, it was one of the moſt populous cities in England. William I. built a caſtle upon the ſummit of the hill above the town. The dioceſe, though the biſhopric of Ely was taken out of it by Henry II. and thoſe of Peterborough and Oxford by Henry VIII. is ſtill vaſtly large, containing the counties of Leiceſter, Huntingdon, Bedford, and part of Bucks, making 1255 pariſhes. Though the other churches are mean, the cathedral or minſter is a moſt magnificent piece of Gothic architecture. Here is a prodigious large bell, called *Tom of Lincoln,* which is near 5 ton in weight, and 23 feet in compaſs. The hill on which the church ſtands is ſo high, and the church itſelf ſo lofty, that it may be ſeen 50 miles to the north, and 30 to the ſouth. Beſides other tombs, it contains one of braſs, in which are the entrails of Queen Eleanor, wife to Edward I. It is ſaid there were anciently 52 churches, which are now reduced to 14. Such is the magnificence and elevation of the cathedral, that the monks thought the ſight of it muſt be very mortifying to the devil; whence it came to be ſaid of one who was diſpleaſed, *that he looked like the devil over Lincoln.* The declivity on which the city is built being ſteep, the communication betwixt the upper and lower town is very troubleſome, and coaches and horſes are obliged to make a compaſs.

King Edward III. made this city a ſtaple for wool, leather, lead, &c. It was once burnt; once beſieged by King Stephen, who was here defeated and taken priſoner; and once taken by Henry III. from his rebellious barons. It abounded heretofore with monaſteries and other religious houſes. There is a great pool here, formed by the river on the weſt ſide of it, called *Swan-Pool,* becauſe of the multitude of ſwans on it. The Romans north gate ſtill remains entire, by the name of *Newport Gate.* It is one of the nobleſt of this ſort in Britain. It is a vaſt ſemicircle of ſtones of very large dimenſions laid without mortar, connected only by their uniform ſhape. This magnificent arch is 16 feet in diameter, the ſtones are four feet thick at the bottom. It ſeems to have a joint in the middle, not a key-ſtone: and on both ſides, towards the upper part, are laid horizontal ſtones of great dimenſions, ſome 10 or 12 feet long. This arch riſes from an impoſt of large mouldings, which are not perceivable now; there are alſo divers fragments of the old Roman wall. Over againſt the caſtle is an entrenchment caſt up by king Stephen; and here are carved the arms of John of Gaunt, duke of Lancaſter, who lived here like a king, and had a mint. The city has a communication with the Trent, by a canal called the Foſs-dyke. In the centre of the ruined old caſtle there is a handſome modern ſtructure for holding the aſſizes. Its walls are almoſt entire, and very ſubſtantial: the Keep or principal tower is ſituated on a high and very ſteep mount, which yet continues in its original ſtate, but the remains of the tower on it are only five or ſix yards high. The outer walls of the caſtle are of very conſiderable height, which appear ſtill higher than they really are from their lofty ſituation and the moat below them. The great gateway is ſtill entire. This city is a county of itſelf; and has a viſcountial juriſdiction for 20 miles round, which is a privilege that no other city in England can equal. It now conſiſts principally of one ſtreet above two miles long, well paved, beſides ſeveral croſs and parallel ſtreets well peopled. Here are ſome very handſome modern buildings, but more antique ones; upon the whole it has an air of ancient greatneſs, ariſing in a great meaſure from the number of monaſtic remains, moſt of which are now converted into ſtables, out-houſes, &c. Upon the hill, in the caſtle are the ruins of the biſhop's palace, and other ruins of ancient grandeur and magnificence. The city is ſupplied with water by ſeveral conduits, among which is a modern one, ſomewhat in the pyramidical ſtyle, enriched with ſculpture. It is governed by a mayor, twelve aldermen, two ſheriffs, a recorder, four chamberlains, a ſword-bearer, four coroners, and above forty common-council men. Here are four charity ſchools, where 120 poor children are taught by the widows of clergymen. The neighbouring courſe is noted for its frequent horſe-races. On the down of Lincoln, towards Boſton, that rare fowl the buſtard is ſeen ſometimes, as well as on Saliſbury-Plain. Lincoln-Heath extends above 50 miles, viz. from Sleaford and Ancaſter ſouth to the Humber north, though it is but three or four miles over where broadeſt. Five miles from Boſton on this extenſive heath, the late Lord Le Deſpenſer built a few years ago a tower for the direction of ſtrangers. It is a lofty ſquare building with a ſtair-caſe, which terminates in a flat roof, and round the baſe is a ſquare court-yard. Great part of this extenſive heath is lately incloſed. The markets here are Tueſdays and Fridays; and there are four fairs in the year. We read that David king of Scots met king John here, on the 22d of November, in the third year of his reign, and performed homage to him on a hill without the city, for his Engliſh territories, in preſence of the archbiſhops of Canterbury, York, and Raguſa, 13 biſhops, and a vaſt number of temporal lords and knights. King Henry VII. kept his court here at Eaſter in 1486. The Jews were once its chief inhabitants, till they were forced to remove, after having impiouſly crucified the child of one Grantham, and thrown it into a well, to this day called *Grantham's Well.* Lincoln has given the title of earl to the family of Clinton ever ſince the reign of Queen Elizabeth. W. Long. 1. 27. N. Lat. 53. 16.

LINCOLN-*Shire*, a maritime county of England, 77 miles in length and 48 in breadth, is bounded on the eaſt by the German ocean, on the weſt by Nottinghamſhire, on the north by Yorkſhire, on the ſouth by Rutlandſhire, Northamptonſhire, and Cambridgeſhire. It contains 4590 houſes, 24,340 inhabitants, 631 pariſhes, and 31 market towns, whereof five ſend members to parliament, which, with two for the county, make twelve in all. The principal rivers are the Humber, the Trent, the Witham, the Nenn, the Welland, the Ankham, and the Dun. It is divided into three parts, Lindſay, Keſtoven, and Holland; the air of which laſt is unwholeſome and foggy, on account of the fens and large marſhes. The ſoil of the north and weſt parts is very fertile, and abounds in corn and paſtures. The eaſt and ſouth parts are not ſo proper for corn; but then they ſupply them with fiſh and fowl in great plenty, particularly ducks and geeſe. Lincoln in the principal town. By the late inland navigation, this county has communication with the rivers Merſey, Dee, Ribble, Ouſe, Darwent, Severn, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles through diverſe counties.

LINDESFARN, or LANDISFARN. See *HOLY-Iſland*.

LINDSAY (Sir David); a celebrated Scots poet, was deſcended of an ancient family, and born in the reign of king James IV. at his father's ſeat called the *Mount*, near Cupar in Fifeſhire. He was educated at the univerſity of St Andrew's; and, after making the tour of Europe, returned to Scotland in the year 1514. Soon after his arrival, he was appointed gentleman of the bed-chamber to the king, and tutor to the young prince,* afterwards James V. From the verſes prefixed to his dream, we learn that he enjoyed ſeveral other honourable employments at court; but in 1533, he was deprived of all his places, except that of *Lion king at arms*, which he held to the time of his death. His diſgrace was moſt probably owing to his invectives againſt the clergy, which are frequent in all his writings. After the deceaſe of king James V. Sir David became a favourite of the earl of Arran, regent of Scotland; but the abbot of Paiſley did not ſuffer him to continue long in favour with the earl. He then retired to his paternal eſtate, and ſpent the remainder of his days in rural tranquillity. He died in the year 1553. His poetical talents, conſidering the age in which he wrote, were not contemptible; but he treats the Romiſh clergy with great ſeverity, and writes with ſome humour; but, whatever merit might be formerly attributed to him, he takes ſuch licentious liberties with words, ſtretching, or carving them for meaſure or rhime, that the Scots have a proverb, when they hear an unuſual expreſſion, that, *There is nae ſic a word in a' Davie Linſay*. Mackenzie tells us, that his comedies were ſo facetious, that they afforded abundance of mirth. Some fragments of theſe comedies are ſtill preſerved in manuſcript. He is ſaid to have alſo written ſeveral tragedies, and to have firſt introduced dramatic poetry into Scotland. One of his comedies was played in 1515. Mackenzie ſays, he underſtood nothing of the rules of the theatre. He was cotemporary with John Heywood, the firſt Engliſh dramatic poet. His poems are printed in one ſmall volume; and fragments of his plays, in manuſcript, are in Mr William Carmichael's collection.

LINDSEY, the third and largeſt diviſion of the county of Lincolnſhire in England. On the eaſt and north it is waſhed by the ſea, into which it runs out with a large front; on the weſt it has Yorkſhire and Nottinghamſhire, from which it is parted by the rivers Trent and Dun; on the ſouth it has Keſtevan, from which it is ſeparated by the river Witham and the Foſs-dyke, which is ſeven miles long, and was cut by Henry I. between the Witham and the Trent, for the convenience of carriage in thoſe parts. It had its name from Lincoln, the capital of the county, which ſtands in it, and by the Romans called *Lindum*, by the Britons *Lindcoit*, by the Saxons *Lindo-collyne*, probably from its ſituation on a hill, and the lakes or woods that were anciently thereabouts; but the Normans called it *Nichol*. It gives title of earl and marquis to the duke of Ancaſter.

LINDUS, (anc. geog.), a town of Rhodes, ſituated on a hill on the weſt ſide of the iſland. It was built by Tlepolemus the ſon of Hercules, according to Diodorus Siculus; by one of the Heliades, grandſons of the Sun, named *Lindus*, according to Strabo. It was the native place of Cleobulus, one of the wiſe men. Here we ſee the famous temple of Lindian Minerva, which was built by the daughters of Danaus. Cadmus enriched this temple with many ſplendid offerings. The citizens dedicated and hung up here the ſeventh of Pindar's Olympic odes, written in letters of gold. The ruins of that ſuperb edifice are ſtill to be ſeen on the top of an high hill which overlooks the ſea. Some remains of the walls, conſiſting of ſtones of an enormous ſize, ſtill ſhow it to have been built in the Egyptian ſtyle. The pillars and other ornaments have been carried off. On the moſt elevated peak of the rock are the ruins of a caſtle which may have ſerved as a forteſs to the city. Its circumference is very extenſive, and is filled with rubbiſh.

Lindo, the modern city, ſtands at the foot of the hill. A bay, of conſiderable wideneſs and depth, ſerves as a harbour to the city. Ships find good anchorage there in twenty fathoms water. They are ſafely ſheltered from the ſouth-weſt winds, which conſtantly prevail through the ſevereſt ſeaſon of the year. In the begining of winter, they caſt anchor off a ſmall village named Maſſary. Before the building of Rhodes, Lindus was the harbour which received the fleets of Egypt and Tyre. It was enriched by commerce. Mr Savary obſerves, that a judicious government, by taking advantage of its harbour and happy ſituation, might yet reſtore it to a flouriſhing ſtate.

LINE, in geometry, a quantity extended in length only, without any breadth or thickneſs. It is formed by the flux, or motion of a point. See FLUXIONS, and GEOMETRY.

LINE, in the art of war, is underſtood of the diſpoſition of an army ranged in order of battle, with the front extended as far as may be, that it may not be flanked.

LINE of Battle, is alſo underſtood of a diſpoſition of the fleet in the day of engagement; on which occaſion the veſſels are uſually drawn up as much as poſſible in a ſtraight line, as well to gain and keep the advantage of the wind as to run the ſame board. See *Naval TACTICS*.

Horizontal LINE, in geography, and aſtronomy, a line drawn parallel to the horizon of any part of the earth.

Equinoctial LINE, in geography, is a great circle on the earth's ſurface, exactly at the diſtance of 90° from each of the poles, and of conſequence biſecting the earth in that part. From this imaginary line, the degrees of longitude and latitude are counted.—In aſtronomy, the equinoctial line is that circle which the ſun ſeems to deſcribe round the earth on the days of the equinox in March and September. See ASTRONOMY and GEOGRAPHY.

Meridian LINE, is an imaginary circle drawn thro' the two poles of the earth and any part of its ſurface. See GEOGRAPHY, n° 29.

Ship of the LINE, a veſſel large enough to be drawn up in the line, and to have a place in a ſea-fight.

LINE, in genealogy, a ſeries or ſucceſſion of relations in various degrees, all deſcending from the ſame common father. See DESCENT.

LINE, alſo denotes a French meaſure containing the 12th part of an inch, or the 144th part of a foot. Geometricians conceive the line ſubdivided into ſix points. The French line anſwers to the Engliſh barley-corn.

Fiſhing LINE. See *Fiſhing Line*.

LINES, in heraldry, the figures uſed in armories to divide the ſhield into different parts, and to compoſe different figures. Theſe lines, according to their different forms and names, give denomination to the pieces or figures which they form, except the ſtraight or plain lines. See HERALDRY.

LINEA ALBA, in anatomy, the concourſe of the tendons of the oblique and tranſverſe muſcles of the abdomen; dividing the abdomen in two, in the middle. It is called *linea*, line, as being ſtraight; and *alba*, from its colour, which is white. The *linea alba* receives a twig of a nerve from the intercoſtals in each of its digitations or indentings, which are viſible to the eye, in lean perſons eſpecially.

LINEAMENT, among painters, is uſed for the outlines of a face.

LINEAR NUMBERS, in mathematics, ſuch as have relation to length only; ſuch is a number which repreſents one ſide of a plain figure. If the plain figure be a ſquare, the linear figure is called a *root*.

LINEAR *Problem*; that which may be ſolved geometrically by the interſection of two right lines. This is called a *ſimple problem*, and is capable but of one ſolution.

LINEN, in commerce, a well known kind of cloth chiefly made of flax.—Linen was not worn by the Jews, Greeks, or Romans, as any part of their ordinary dreſs. Under tunicks of a finer texture ſupplied the place of ſhirts: Hence the occaſion for frequent bathing. Alexander Severus was the firſt emperor who wore a ſhirt: but the uſe of ſo neceſſary a garment did not become common till long after him.

The linen manufacture was probably introduced into Britain with the firſt ſettlement of the Romans. The flax was certainly firſt planted by that nation in the Britiſh ſoil. The plant itſelf indeed appears to have been originally a native of the eaſt. The woollen drapery would naturally be prior in its origin to the linen; and the fibrous plants from which the threads of the latter are produced, ſeem to have been firſt noticed and worked by the inhabitants of Egypt. In Egypt, indeed, the linen manufacture appears to have been very early: for even in Joſeph's time it had riſen to a conſiderable height. From the Egyptians the knowledge of it proceeded probably to the Greeks, and from them to the Romans. Even at this day the flax is imported among Europeans from the eaſtern nations; the weſtern kind being merely a degenerate ſpecies of it.

In order to ſucceed in the linen manufacture, one ſet of people ſhould be confined to the ploughing and preparing the ſoil, ſowing and covering the ſeed, to the weeding, pulling, rippling, and taking care of the new ſeed, and watering and dreſſing the flax till it is lodged at home: others ſhould be concerned in the drying, breaking, ſcutching, and heckling the flax, to fit it for the ſpinners; and others in ſpinning and reeling it, to fit it for the weaver; others ſhould be concerned in taking due care of the weaving, bleaching, beetling, and finiſhing the cloth for the market. It is reaſonable to believe, that if theſe ſeveral branches of the manufacture were carried on by diſtinct dealers, where the home-made linens are manufactured, the ſeveral parts would be better executed, and the whole would be afforded cheaper, and with greater profit.

Staining of LINEN. Linen receives a black colour with much more difficulty than woollen or cotton. The black ſtruck on linen with common vitriol and galls or logwood, is very periſhable, and ſoon waſhes out.—Inſtead of the vitriol, a ſolution of iron in ſour ſtrong beer is to be made uſe of. This is well known to all the calico printers; and by the uſe of this, which they call their *iron liquor*, and madder-root, are the blacks and purples made which we ſee on the common printed linens. The method of making this iron-liquor is as follows: A quantity of iron is put into the ſour ſtrong beer; and, to promote the diſſolution of the metal, the whole is occaſionally well ſtirred, the liquor occaſionally drawn off, and the ruſt beat from the iron, after which the liquor is poured on again. A length of time is required to make the impregnation perfect; the ſolution being reckoned unfit for uſe till it has ſtood at leaſt a twelvemonth. This ſolution ſtains the linen of a yellow, and different ſhades of buff-colour; and is the only known ſubſtance by which theſe colours can be fixed on linen. The cloth ſtained deep with the iron liquor, and afterwards boiled with madder without any other addition, becomes of the dark colour which we ſee on printed linens and cottons; which if not a perfect black, has a very near reſemblance to it. Others are ſtained paler with the ſame liquor diluted with water, and come out purple.

Linen may alſo be ſtained of a durable purple by means of ſolution of gold in aqua regia. The ſolution for this purpoſe ſhould be as fully ſaturated as poſſible; it ſhould be diluted with three times its quantity of water; and if the colour is required deep, the piece, when dry, muſt be repeatedly moiſtened with it. The colour does not take place till a conſiderable time, ſometimes ſeveral days, after the liquor has been applied: to haſten its appearance, the ſubject ſhould be expoſed to the ſun and free air, and occaſionally removed to a moiſt place, or moiſtened with water.—When ſolution of gold in aqua regia is ſoaked up in linen cloths, the metal may be recovered by drying and burning them.

The anacardium nut, which comes from the Eaſt-Indies, is remarkable for its property of ſtaining linen of a deep black colour, which cannot be waſhed out either with ſoap or alkaline ley. The ſtain is at firſt of a rediſh-brown, but afterwards turns to a deep black on expoſure to the air. The caſhew-nut, called the *ancardium of the Weſt-Indies*, differs from the oriental anacardium in its colouring quality. The juice of this nut is much paler than the other, and ſtains linen or cotton only of a browniſh colour; which indeed is very durable, but does not at all change toward blackneſs.—There are, however, trees, natives of the United States, which appear to contain juices of the

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ſame nature with thoſe of India. Of this kind are ſeveral, and perhaps the greater number, of the ſpecies of the toxicodendron or poiſon tree †. Mr Cateſby, in his hiſtory of Carolina, deſcribes one called there the *poiſon-aſh*, from whoſe trunk flowed a liquid as black as ink, and ſuppoſed to be poiſonous; which reputed poiſonous quality has hitherto prevented the inhabitants from collecting or attempting to make any uſe of it. In the Philoſophical Tranſactions for the year 1755, the abbé Mazeas gives an account of three ſorts of the toxicodendron raiſed in a botanic garden in France, containing in their leaves a milky juice, which in drying became quite black, and communicated the ſame colour to the linen on which it was dropped. The linen thus ſtained was boiled with ſoap, and came out without the leaſt diminution of colour; nor did a ſtrong ley of wood-aſhes make any change in it. Several of theſe trees have been planted in the open ground in England, and ſome ſtill remain in the biſhop of London's garden at Fulham.

That ſpecies called by Mr Miller the *true lac tree*, was found by Dr Lewis to have properties of a ſimilar kind. It contains in its bark, and the pedicles and ribs of the leaves, a juice ſomewhat milky, which ſoon changed in the air to a reddiſh-brown, and in two or three hours to a deep blackiſh or browniſh-black colour: wherever the bark was cut or wounded, the inciſion became blackiſh; and on ſeveral parts of the leaves the juice had ſpontaneouſly exſuded, and ſtained them of the ſame colour. This juice dropped on linen gave at firſt little or no colour, looking only like a ſpot of oil; but, by degrees, the part moiſtened with it darkened in the ſame manner as the juice itſelf. On waſhing and boiling the linen with ſoap, the ſtain not only was not diſcharged, but ſeemed to have its blackneſs rather improved; as if a brown matter, with which the black was manifeſtly debaſed, had been in part waſhed out, and left the black more pure.

As the milky juice of ſome of the common plants turn dark-coloured or blackiſh in drying, the Doctor was induced to try the effects of ſeveral of them on linen. The milks of wild-poppies, garden-poppies, dandelion, hawk-weed, and ſow-thiſtle, gave brown or browniſh-red ſtains, which were diſcharged by waſhing with ſoap; the milks of the fig-tree, of lettuces, and of different kinds of ſpurges, gave no colour at all. The colourleſs juice which iſſues from hop-ſtalks when cut, ſtains linen of a pale-reddiſh, or browniſh-red, extremely durable; the colour was deepened by repeated applications of the juice, but it never made any approach to blackneſs. The juice of ſloes gave likewiſe a pale-browniſh ſtain, which by repeated waſhings with ſoap, and being wetted with ſtrong ſolution of alkaline ſalt, was darkened to a deeper brown: on baking the ſloes, their juice turns red; and the red ſtain which it then imparts to linen is, on waſhing with ſoap, changed to a pale-bluiſh, which alſo proves durable. Theſe colours could not be deepened by repeated applications of the juice. The ſloes were tried in different ſtates of maturity, from the beginning of September to the middle of December, and the event was always nearly the ſame.

In the fifth volume of Linnæus's *Amænitates Academicæ*, mention is made of a black colour obtained from two plants which grow ſpontaneouſly in Britain; the one is the *actæa ſpicata*, herb-chriſtopher, or bane-berries; the other the *erica baccifera nigra*, black-berried heath, crow-berries, or crake-berries. The juice of the bane-barries, boiled with alum, is ſaid to yield a black ink; and the heath-berries, boiled alſo with alum, to dye linen of a purpliſh black.

Linen *flowered with Gold-leaf*. Dr Lewis informs us of a late manufacture eſtabliſhed in London for embelliſhing linen with flowers and ornaments of gold-leaf. The linen, he ſays, looks whiter than moſt of the printed linens; the gold is extremely beautiful, and bears waſhing well. The Doctor informs us, that he had ſeen a piece which he was credibly informed had been waſhed three or four times, with only the ſame precautions which are uſed for the finer printed linens; and on which the gold continued entire, and of great beauty.—Concerning the proceſs uſed in this manufacture, he gives us no particulars.

Foſſile Linen, is a kind of amianthus, which conſiſts of flexible, parallel, ſoft fibres, and which has been celebrated for the uſes to which it has been applied, of being woven, and forming an *incombuſtible cloth*. Paper alſo, and wicks for lamps, have been made of it. See Amianthus and Asbestos.

LING, in zoology. See Gadus.

LINGEN, a ſtrong town of Germany, in the circle of Weſtphalia, and capital of a county of the ſame name. It belongs to the king of Pruſſia; and is ſituated on the river Embs, in E. Long. 7. 30. N. Lat. 52. 32.

LINGELBACH (John), an excellent painter, born at Franckfort on the Maine in 1625. He firſt learned the art in Holland, but perfected himſelf at Rome; where he ſtudied till he was 25 years of age, when he ſettled at Amſterdam. His uſual ſubjects are fairs, mountebanks, ſea-pieces, and lanſcapes, which he compoſed and executed exceedingly well: his landſcapes are enriched with antiquities, animals, and elegant figures; his ſea-fights are full of expreſſion, exciting pity and terror, and all his objects are well deſigned. He had an uncommon readineſs in painting figures and animals, on which account he was employed by ſeveral eminent artiſts to adorn their landſcapes with ſuch objects; and whatever he inſerted in the works of other maſters, were always well adapted, and produced an agreeable effect. He died in 1687.

LINIMENT, in pharmacy, a compoſition of a conſiſtence ſomewhat thinner than an unguent, and thicker than an oil uſed for anointing different parts of the body in various intentions.——The materials proper for compoſing liniments are, fats, oil, balſams, and whatever enters the compoſition of unguents and plaſters.

LINLITHGOW, the chief town of Weſt Lothian in Scotland. It is ſuppoſed to be the *Lindum* of Ptolemy; and to take its name from its ſituation on a lake, which the word *Lin* or *Lyn* ſignifies.——It is diſtant 16 miles from Edinburgh, and is a royal borough and ſeat of a preſbytery. It contains between three and four thouſand ſouls; and carries on a conſiderable trade in dreſſing of white leather, which is ſent abroad to be manufactured. It alſo employs many hands in dreſſing of flax; alſo in wool-combing, the wool for which is

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† See *Rhus*.

brought from the borders. Its port was formerly *Blackneſs*; but ſince the decline of that place, *Burrowſtounneſs*, about two miles diſtant from Linlithgow. The town conſiſts of one open ſtreet, from whence lanes are detached on both ſides; the houſes are built of ſtone, tolerably neat and commodious; and the place is adorned with ſome ſtately public edifices. The palace, built, as Sibbald ſuppoſed, on the ſite of a Roman ſtation, forms a ſquare with towers at the corners, and ſtands on a gentle eminence, with the beautiful loch behind it to the weſt. It was one of the nobleſt of the royal reſidences; and was greatly ornamented by James V. and VI. Within the palace is a handſome ſquare; one ſide of which is more modern than the others, having been built by James VI. and kept in good repair till 1746, when it was accidentally damaged by the king's forces making fires on the hearths, by which means the joiſts were burnt. A ſtone ornamented fountain in the middle of the court was deſtroyed at the ſame time. The other ſides of the ſquare are more ancient. In one is a room ninety-five feet long, thirty feet ſix inches wide, and thirty-three feet high. At one end is a gallery with three arches, perhaps for muſic. Narrow galleries run quite round the old part, to preſerve communications with the rooms; in one of which the unfortunate Mary Stuart firſt ſaw light. On the north ſide of the high ſtreet, on an eminence eaſt of the palace, ſtands St Michael's church; a handſome ſtructure, where James V. intended to have erected a throne and twelve ſtalls for the ſovereign and knights of the order of St Andrew. In the market-place is another fountain of two ſtories with eight ſpouts, and ſurmounted like the former with an imperial crown. In one of the ſtreets is ſhown the gallery whence the regent Murray was ſhot. Here was a houſe of Carmelites, founded by the townſpeople in 1290, deſtroyed by the reformers 1559. The family of Livingſton, who take the title of earl from this place, are hereditary keepers of this palace, as alſo bailiffs of the king's bailifry, and conſtables of Blackneſs caſtle; but by their concern in the rebellion of 1715 all theſe honours with their eſtate were forfeited to the crown. Sir James Livingſton, ſon of the firſt earl by marriage with a daughter of Callendar, was created earl of Callendar by Charles I. 1641, which title ſunk into the other.

LINNÆUS (Sir Charles), a celebrated botaniſt and natural hiſtorian, was born on May 24. 1707, in a village called *Roeſhult* in Smaland, where his father, Nicholas Linnæus, was then vicar, but afterwards preferred to the curacy of Stenbrohult. We are told, that on the farm where Linnæus was born, there yet ſtands a large lime-tree, from which his anceſtors took the ſurnames of *Tiliander*, *Lindelius*, and *Linnæus*; and that this origin of ſurnames, taken from natural objects, is not uncommon in Sweden.

This emeat man, whoſe talents enabled him to reform the whole ſcience of natural hiſtory, accumulated, very early in life, ſome of the higheſt honours that await the moſt ſucceſsful proficients in medical ſcience; ſince we find that he was made profeſſor of phyſic and botany, in the univerſity of Upſal, at the age of 34; and ſix years afterwards, phyſician to his ſovereign the late king Adolphus; who in the year 1753 honoured him ſtill farther, by creating him knight of the order of the Polar Star. His honours did not terminate here: for in 1757 he was ennobled; and in 1776 the late king of Sweden accepted the reſignation of his office, and rewarded his declining years by doubling his penſion, and by a liberal donation of landed property ſettled on him and his family.

From Dr Pulteney's General View of the Life and Writings of Linnæus.

It ſeems probable, that Linnæus's taſte for the ſtudy of nature was caught from the example of his father; who, as he has himſelf informed us, cultivated, as his firſt amuſement, a garden plentifully ſtored with plants. Young Linnæus ſoon became acquainted with theſe, as well as with the indigenous ones of his neighbourhood. Yet, from the ſtraitneſs of his father's income, our young naturaliſt was on the point of being deſtined to a mechanical employment: fortunately, however, this deſign was over-ruled. In 1717 he was ſent to ſchool at Wexſio; where, as his opportunities were enlarged, his progreſs in all his favourite purſuits was proportionably extended. At this early period he paid attention to other branches of natural hiſtory, particularly to the knowledge of inſects.

The firſt part of his academical education Linnæus received under profeſſor Stobæus, at Lund, in Scania, who favoured his inclinations to the ſtudy of natural hiſtory. After a reſidence of about a year, he removed in 1728 to Upſal. Here he ſoon contracted a cloſe friendſhip with Artedi, a native of the province of Angermania, who had already been four years a ſtudent in that univerſity, and, like himſelf, had a ſtrong bent to the ſtudy of natural hiſtory in general, but particularly to ichthyology. Soon after his reſidence at Upſal, our author was alſo happy enough to obtain the favour of ſeveral gentlemen of eſtabliſhed character in literature. He was in a particular manner encouraged in the purſuit of his ſtudies by the patronage of Dr Olaus Celſius, at that time profeſſor of divinity, and the reſtorer of natural hiſtory in Sweden; who, being ſtruck with the diligence of Linnæus in deſcribing the plants of the Upſal garden, and his extenſive knowledge of their names, not only patronized him in a general way, but admitted him to his houſe, his table, and his library. Under ſuch encouragement it is not ſtrange that our author made a rapid progreſs, both in his ſtudies and the eſteem of the profeſſors: in fact, we have a very ſtriking proof of his merit and attainments, inaſmuch as we find, that, after only two years reſidence, he was thought ſufficiently qualified to give lectures occaſionally from the botanic chair, in the room of the profeſſor Rudbeck.

In the year 1731, the royal academy of ſciences at Upſal having for ſome time meditated the deſign of improving the natural hiſtory of Sweden, at the inſtance particularly of profeſſors Celſius and Rudbeck, deputed Linnæus to make the tour of Lapland, with the ſole view of exploring the natural hiſtory of that arctic region; to which undertaking, his reputation, already high as a naturaliſt, and the ſtrength of his conſtitution, equally recommended him. He left Upſal the 13th of May, and took his route to Gevalia or Gevels, the principal town of Geſtricia, 45 miles diſtant from Upſal. Hence he travelled through Helſingland into Medalpadia, where he made an excurſion, and aſcended a remarkable mountain, before he reached Hudwickſwald, the chief town of Helſingland. From hence he went through Angermanland to Hernoſand, a ſea-port on the Bothnic gulf, 70 miles diſtant from Hudwickſwald. When he had proceeded thus far, he found it proper to retard his journey, as the ſpring was not ſufficiently advanced; and took this opportunity of viſiting thoſe remarkable caverns on the ſummit of mount Skula, though at the hazard of his life.

When Linnæus arrived at Uma, in Weſt Bothnia, about 96 miles from Hernoſand, he quitted the public road, and took his courſe through the woods weſtward, in order firſt to traverſe the moſt ſouthern parts of Lapland. Being now come to the country that was more particularly the object of his inquiries, equally a ſtranger to the language and to the manners of the people, and without any aſſociate, he committed himſelf to the hoſpitality of the inhabitants, and never failed to experience it fully. He ſpeaks in ſeveral places, with peculiar ſatisfaction, of the innocence and ſimplicity of their lives and their freedom from diſeaſes. In this excurſion he reached the mountains towards Norway; and after encountering great hardſhips, returned into Weſt Bothnia, quite exhauſted with fatigue. Our traveller next viſited Pitha and Lula, upon the gulf of Bothnia; from which latter place he took again a weſtern route, by proceeding up the river of that name, and viſited the ruins of the temple of Jockmock in Lula Lapland or Lap Mark: thence he traverſed what is called the *Lapland Deſert*, deſtitute of all villages, cultivation, roads, or any conveniences; inhabited only by a few ſtraggling people, originally deſcended from the Finlanders, and who ſettled in this country in remote ages, being entirely a diſtinct people from the Laplanders. In this diſtrict he aſcended a noted mountain called *Wallevari;* in ſpeaking of which he has given us a pleaſant relation of his finding a ſingular and beautiful new plant (*Andromeda tetragona*) when travelling within the arctic circle, with the ſun in his view at midnight, in ſearch of a Lapland hut. From hence he croſſed the Lapland Alps into Finmark, and traverſed the ſhores of the north ſea as far as Sallero.

Theſe journeys from Lula and Pitha on the Bothnian gulf, to the north ſhore, were made on foot; and our traveller was attended by two Laplanders, one his interpreter, and the other his guide. He tells us, that the vigour and ſtrength of thoſe two men, both old, and ſufficiently loaded with his baggage, excited his admiration; ſince they appeared quite unhurt by their labour, while he himſelf, although young and robuſt, was frequently quite exhauſted. In this journey he was wont to ſleep under the boat with which they forded the rivers, as a defence againſt rain, and the gnats, which in the Lapland ſummer are not leſs teazing than in the torrid zone. In deſcending one of theſe rivers he narrowly eſcaped periſhing by the overſetting of the boat, and loſt many of the natural productions which he had collected.

Linnæus thus ſpent the greater part of the ſummer in examining this arctic region, and thoſe mountains on which, four years afterwards, the French philoſophers ſecured immortal fame to Sir Iſaac Newton. At length, after having ſuffered incredible fatigues and hardſhips in climbing precipices, paſſing rivers in miſerable boats, ſuffering repeated viciſſitudes of extreme heat and cold, and not unfrequently hunger and thirſt, he returned to Tornoa in September. He did not take the ſame route from Tornoa as when he came into Lapland, having determined to viſit and examine the country on the eaſtern ſide of the Bothnian gulf: his firſt ſtage, therefore, was to Ula in Eaſt Bothnia; from thence to Old and New Carleby, 84 miles ſouth from Ula. He continued his route through Waſa, Chriſtianſtadt, and Biorneburgh, to Abo, a ſmall univerſity in Finland. Winter was now ſetting in apace; he therefore croſſed the gulf by the iſland of Aland, and arrived at Upſal in November, after having performed, and that moſtly on foot, a journey of ten degrees of latitude in extent; excluſively of thoſe deviations which ſuch a deſign rendered neceſſary.

In 1733 he viſited and examined the ſeveral mines in Sweden; and made himſelf ſo well acquainted with mineralogy and the docimaſtic art, that we find he was ſufficiently qualified to give lectures on thoſe ſubjects, upon his return to the univerſity. The outlines of his ſyſtem on mineralogy appeared in the early editions of the *Syſtema Naturæ*; but he did not exemplify the whole until the year 1768.

In the year 1734 Linnæus was ſent by baron Reuterholm, governor of Dalekarlia, with ſeveral other naturaliſts in that province, to inveſtigate the natural productions of that part of the Swediſh dominions; and it was in this journey that our author firſt laid the plan of an excellent inſtitution, which was afterwards executed, in a certain degree at leaſt, by himſelf, with the aſſiſtance of many of his pupils, and the reſult publiſhed under the title of *Pan Suecus*, in the ſecond volume of the *Amœnitates Academicæ*.

After the completion of this expedition, it appears that Linnæus reſided for a time at Fahlun, the principal town in Dalekarlia: where he tells us, that he taught mineralogy and the docimaſtic art, and practiſed phyſic; and where he was very hoſpitably treated by Dr Moore, the phyſician of the place. It alſo appears, that he contracted at this time an intimacy with one of that gentleman's daughters, whom he married about five years afterwards upon his ſettling as a phyſician at Stockholm.—In this journey he extended his travels quite acroſs the Dalekarlian Alps into Norway; but we have no particular account of his diſcoveries in that kingdom. In 1735 Linnæus travelled over many other parts of Sweden, ſome parts of Denmark and Germany, and fixed in Holland, where he chiefly reſided until his return to Stockholm, about the year 1739. In 1735, the year in which he took the degree of M. D. he publiſhed the firſt ſketch of his *Syſtema Naturæ*, in a very compendious way, and in the form of tables only, in 12 pages in folio. By this it appears that he had at a very early period of his life (certainly before he was 24 years old) laid the baſis of that great ſtructure which he afterwards raiſed, not only to the increaſe of his own fame, but to that of natural ſcience.

In 1736, Linnæus came into England, and viſited Dr Dillenius, the late learned profeſſor at Oxford, whom he juſtly conſidered as one of the firſt botaniſts in Europe. He mentions with particular reſpect the civilities he received from him, and the privileges he gave him of inſpecting his own and the Sherardian collection of plants. It is needleſs to ſay, that he viſited Dr Martyn, Mr Rand, and Mr Miller, and that he was in a more ſingular manner indebted to the friendſhip of Dr Iſaac Lawſon. He alſo contracted an intimate friendſhip with Mr Peter Collinſon, which was reciprocally increaſed by a multitude of good offices, and continued to the laſt without any diminution. Dr Boerhaave had furniſhed him with letters to that great naturaliſt Sir Hans Sloane; but it is with regret that we muſt obſerve, they did not procure him the reception which the warmth of his recommendation ſeemed to claim.

One of the moſt agreeable circumſtances that happened to Linnæus during his reſidence in Holland, aroſe from the patronage of Mr Clifford, in whoſe houſe he lived a conſiderable part of his time, being now as it were the child of fortune:—*Exivi patriâ triginta ſex nummis aureis dives*—are his own words. With Mr Clifford, however, he enjoyed pleaſures and privileges ſcarcely at that time to be met with elſewhere in the world; that of a garden excellently ſtored with the fineſt exotics, and a library furniſhed with almoſt every author of note. How happy he found himſelf in this ſituation, thoſe only who have felt the ſame kind of ardour can conceive. Whilſt in Holland, our author was recommended by Boerhaave to fill the place, then vacant, of phyſician to the Dutch ſettlement at Surinam; but he declined it on account of his having been educated in ſo oppoſite a climate.

Beſides being favoured with the particular patronage and friendſhip of Boerhaave and Mr Clifford, as is abovementioned, our author had alſo the pleaſure of being contemporary with, and of reckoning among the number of his friends, many other learned perſons who have ſince proved ornaments to their profeſſion, and whoſe merit has moſt deſervedly raiſed them to fame and honour. Among theſe we may properly mention Dr John Burman, profeſſor of botany at Amſterdam, whoſe name and family are well known in the republic of letters, and to whom our author dedicated his *Bibliotheca Botanica*, having been greatly aſſiſted in compiling that work by the free acceſs he had to that gentleman's excellent library; John Frederick Gronovius of Leyden, editor of Clayton's *Flora Virginica*, and who very early adopted Linnæus's ſyſtem; Baron Van Swieten, late phyſician to the Empreſs Queen; Iſaac Lawſon, beforementioned, afterwards one of the phyſicians to the Britiſh army, who died much regretted at Ooſterhout in the year 1747, and from whom Linnæus received ſingular and very important civilities; Kramer, ſince well known for an excellent treatiſe on the docimaſtic art; Van Royen, botanic profeſſor at Leyden; Liebberkun of Berlin, famous for his ſkill in microſcopical inſtruments and experiments. To theſe may be added alſo the names of Albinus and Gaubius, and of others, were it requiſite to ſhow that our author's talents had very early rendered him conſpicuous, and gained him the regard of all thoſe who cultivated and patroniſed any branch of medical ſcience, and to which, doubtleſs, the ſingular notice with which Boerhaave honoured him did not a little contribute.

Early in the year 1738, after Linnæus had left Mr Clifford, and, as it ſhould ſeem, when he reſided with Van Royen, he had a long and dangerous fit of ſickneſs; and upon his recovery went to Paris, where he was properly entertained by the Juſſieus, at that time the firſt botaniſts in France. The opportunity this gave him of inſpecting the Herbaria of Surian and Tournefort, and thoſe of the above-named gentlemen, afforded him great ſatisfaction. He had intended to have gone from thence into Germany, to viſit Ludwig and the celebrated Haller, with whom he was in cloſe correſpondence; but he was not able to complete this part of his intended route, and was obliged to return without this gratification.

Our author did not fail to avail himſelf of every advantage that acceſs to the ſeveral muſeums of this country afforded him, in every branch of natural hiſtory; and the number and importance of his publications, during his abſence from his native country, ſufficiently demonſtrate that fund of knowledge which he muſt have imbibed before, and no leſs teſtify his extraordinary application. Theſe were, *Syſtema Naturæ*, *Fundamenta Botanica*, *Bibliotheca Botanica* and *Genera Plantarum*; the laſt of which is juſtly conſidered as the moſt valuable of all the works of this celebrated author. What immenſe application had been beſtowed upon it, the reader may eaſily conceive, on being informed, that before the publication of the firſt edition the author had examined the characters of 8000 flowers. The laſt book of Linnæus's compoſition, publiſhed during his ſtay in Holland, was the *Claſſes Plantarum*, which is a copious illuſtration of the ſecond part of the *Fundamenta*.

About the latter end of the year 1738, or the beginning of the next, our author ſettled as a phyſician at Stockholm, where he ſeems to have met with conſiderable oppoſition, and was oppreſſed with many difficulties, but all of theſe at length he overcame, and got into extenſive practice; and ſoon after his ſettlement, married the lady before ſpoken of. By the intereſt of Count Teſſin, who was afterwards his great patron, and even procured medals to be ſtruck in honour of him, he obtained the rank of phyſician to the fleet, and a ſtipend from the citizens for giving lectures in botany. And what at this time eſpecially was highly favourable to the advancement of his character and fame, by giving him an opportunity of diſplaying his abilities, was the eſtabliſhment of the Royal Academy of Sciences at Stockholm; of which Linnæus was conſtituted the firſt preſident, and to which eſtabliſhment the king granted ſeveral privileges, particularly that of free poſtage to all papers directed to the ſecretary. By the rules of the academy, the preſident held his place but three months. At the expiration of that term, Linnæus made his *Oratio de memorabilibus in Inſectis*, Oct. 3. 1739; in which he endeavours to excite an attention and inquiry into the knowledge of inſects by diſplaying the many ſingular phenomena that occur in contemplating the nature of thoſe animals, and by pointing out, in a variety of inſtances, their uſefulneſs to mankind in particular, and to the economy of nature in general.

During all this time, however, Linnæus appears to have had his eye upon the botanic and medical chair at Upſal, at this time occupied by Rudbeck, who was far advanced in life. We learn indeed that he was ſo intent on purſuing and perfecting his great deſigns in the advancement of his favourite ſtudy of nature, that he had determined, if he failed in procuring the profeſſorſhip at Upſal, to accept the offer that had been made to him by Haller of filling the botanic chair at Gottingen. However, in courſe of time, he obtained his wiſh. In the year 1741, upon the reſignation

ſignation of Roberg, he was conſtituted joint profeſſor of phyſic and phyſician to the king with Roſen, who had been appointed in the preceding year on the death of Rudbeck. Theſe two colleagues agreed to divide the medical departments between them; and their choice was confirmed by the univerſity. Roſen took anatomy, phyſiology, pathology, and the therapeutic part; Linnæus, natural hiſtory, botany, materia medica, the diatetic part, and the diagnoſis morborum.

During the interval of his removal from Stockholm to Upſal in conſequence of this appointment, our profeſſor was deputed by the ſtates of the kingdom to make a tour to the iſlands of Oeland Gothland in the Baltic, attended by ſix of the pupils, commiſſioned to make ſuch inquiries as might tend to improve agriculture and arts in the kingdom, to which the Swediſh nation had for ſome time paid a particular attention. The reſult of this journey was very ſucceſsful, and proved fully ſatisfactory to the ſtates, and was afterwards communicated to the public. On his return he entered upon the profeſſorſhip, and pronounced before the univerſity his oration *de Peregrinationum intra Patriam neceſſitate*, October 17. 1741; in which he forcibly diſplays the uſefulneſs of ſuch excurſions, by pointing out to the ſtudents that vaſt field of objects which their country held out to their cultivation, whether in geography, phyſics, mineralogy, botany, zoology, or economics, and by ſhowing the benefit that muſt accrue to themſelves and their country as rewards to their diligence. That animated ſpirit which runs through the whole of this compoſition, renders it one of the moſt pleaſing and inſtructive of all our author's productions.

Linnæus was now fixed in the ſituation that was the beſt adapted to his character, his taſte, and abilities; and which ſeems to have been the object of his ambition and centre of his hopes. Soon after his eſtabliſhment, he laboured to get the academical garden, which had been founded in 1657, put on a better footing, and very ſoon effected it; procuring alſo a houſe to be built for the reſidence of the profeſſor. The whole had been in ruin ever ſince the fire in 1702; and at the time Linnæus was appointed profeſſor of botany, the garden did not contain above fifty plants that were exotic. His correſpondence with the firſt botaniſts in Europe ſoon ſupplied him with great variety. He received Indian plants from Juſſieu of Paris, and from Van Royen of Leyden; European plants from Haller and Ludwig; American plants from the late Mr Collinſon, Mr Cateſby, and others; and variety of annuals from Dillenius: in ſhort, how much the garden owed to his diligence and care in a few years, may be ſeen by the catalogue publiſhed under the title of *Hortus Upſalienſis, exhibens Plantas exoticas horto Upſalienſis Academiæ a ſeſe (Linnæo) illatos ab anno* 1742, *in annum* 1748, *additis, differentiis ſynonymis, habitationibus, hoſpitiis, rariorumque deſcriptionibus, in gratiam ſtudioſæ juventutis;* Holm. 1748, 8vo. pp. 306. tab. 3. By this catalogue it appears, that the profeſſor had introduced 1100 ſpecies, excluſively of all the Swediſh plants and of varieties; which latter, in ordinary gardens, amount not unfrequently to one third of the whole number. The preface contains a curious hiſtory of the climate at Upſal, and the progreſs of the ſeaſons throughout the whole year.

From the time that Linnæus and Roſen were appointed profeſſors at Upſal, it ſhould ſeem that the credit of that univerſity, as a ſchool of phyſic, had been increaſing: numbers of ſtudents reſorted thither from Germany, attracted by the character of theſe two able men; and in Sweden itſelf many young men were invited to the ſtudy of phyſic by the excellent manner in which it was taught, who otherwiſe would have engaged in different purſuits.

Whilſt Linnæus was meditating one of his capital performances, which had long been expected and greatly wiſhed for, he was interrupted by a tedious and painful fit of the gout, which left him in a very weak and diſpirited ſtate; and, according to the intelligence that his friends gave of him, nothing was thought to have contributed more to the reſtoration of his ſpirits than the ſeaſonable acquiſition, at this juncture, of a collection of rare and undeſcribed plants.

The fame which our author had now acquired by his *Syſtema Naturæ*, of which a ſixth edition, much enlarged, had been publiſhed at Stockholm in 1748 in 8vo, pp. 232. with eight tables explanatory of the claſſes and orders (and which was alſo republiſhed by Gronovius at Leyden), had brought, as it were, a conflux of every thing rare and valuable in every branch of nature, from all parts of the globe, into Sweden. The king and queen of Sweden had their ſeparate collections of rarities; the former at Ulriekſdahl; the latter, very rich in exotic inſects and ſhells, procured at a great expence, at the palace of Drottningholm; both of which our author was employed in arranging and deſcribing. Beſides theſe, the muſeum of the royal academy of Upſal had been augmented by a conſiderable donation from the king, whilſt hereditary prince, in 1746; by another from Count Gyllenborg the year before; by a third from M. Grill, an opulent citizen of Stockholm.

From this time we ſee the profeſſor in a more elevated rank and ſituation in life. His reputation had already procured him honours from almoſt all the royal ſocieties in Europe; and his own ſovereign, truly ſenſible of his merit, and greatly eſteeming his character and abilities, favoured him with a mark of his diſtinction and regard, by creating him a knight of the polar ſtar. It was no longer *laudatur et alget*. His emoluments kept pace with his fame and honours: his practice in his profeſſion became lucrative; and we find him ſoon after poſſeſſed of his country-houſe and gardens at Hommarby, about five miles from Upſal. He had moreover received one of the moſt flattering teſtimonies of the extent and magnitude of his fame that perhaps was ever ſhown to any literary character, the ſtate of the nation which conferred it with all its circumſtances, duly conſidered. This was an invitation to Madrid from the king of Spain, there to preſide as a naturaliſt, with the offer of an annual penſion for life of 2000 piſtoles, letters of nobility, and the perfect free exerciſe of his own religion: But, after the moſt perfect acknowledgments of the ſingular honour done him, he returned for anſwer, 'that if he had any merits, they were due to his own country.'

In the year 1755, the Royal Academy of Sciences at Stockholm honoured our profeſſor with one of the firſt premiums, agreeably to the will of Count Sparree;

who had decreed two gold medals, of ten ducats value each to be annually given by the academy to the authors of ſuch papers, in the preceding year's Stockholm Acts, as ſhould be adjudged moſt uſeful in promoting agriculture particularly, and all branches of rural economy. This medal bore on one ſide the arms of the count, with this motto. *Superſtes in ſcientiis amor Frederici Sparre.* Linnæus obtained it in conſequence of a paper *De Plantis, quæ Alpium Suecicarum indigenæ, magno rei œconomicæ et medicæ emolumento fieri poſſint*; and the ultimate intention was to recommend theſe plants, as adapted to culture in Lapland. This paper was inſerted in the Stolkholm Acts for 1754, Vol. XV. Linnæus alſo obtained the *præmium centum aureorum*, propoſed by the Imperial academy of ſciences at Peterſburgh, for the beſt paper written to eſtabliſh or diſprove, by new arguments, the doctrine of the ſexes of plants. It was, if poſſible, an additional glory to Linnæus to have merited this premium from the Peterſburgh academy; inaſmuch as a profeſſor of that ſociety, a few years before, had with more than common zeal, although with a futility like that of the other antagoniſts of our author, endeavoured to overturn the whole Linnæan ſyſtem of botany, by attempting to ſhow that the doctrine of the ſexes of plants had no foundation in nature, and was unſupported by facts and experiments.

It appears that Linnæus, upon the whole, enjoyed a good conſtitution; but that he was ſometimes ſeverely afflicted with a *hemicrania*, and was not exempted from the gout. About the cloſe of 1776, he was ſeized with an apoplexy, which left him paralytic; and at the beginning of the year 1777, he ſuffered another ſtroke, which very much impaired his mental powers. But the diſeaſe ſuppoſed to have been the more immediate cauſe of his death, was an ulceration of the urinary bladder, of which, after a tedious indiſpoſition, he died, January 11. 1778, in the 71ſt year of his age.—His principal other works, beſide thoſe already mentioned, are, The *Iter Oelandicum et Gotlandicum, Iter Scanicum, Flora Suecica, Fauna Suecica, Materia Medica, Philoſophia Botanica, Genera Morborum*, different papers in the *Acta Upſalienſia*, and the *Amœnitates Academicæ*. The laſt of this great man's treatiſes was the *Mantiſſa Altera*, publiſhed in 1771; but before his death he had finiſhed the greateſt part of the *Mantiſſa Tertia*, afterwards completed and publiſhed by his ſon.

To the lovers of ſcience it will not appear ſtrange, nor will it be unpleaſant to hear, that uncommon reſpect was ſhown to the memory of this great man. We are told, that "on his death a general mourning took place at Upſal, and that his funeral proceſſion was attended by the whole univerſity, as well profeſſors as ſtudents, and the pall ſupported by ſixteen doctors of phyſic, all of whom had been his pupils." The king of Sweden, after the death of Linnæus, ordered a medal to be ſtruck, of which one ſide exhibits Linnæus's buſt and name, and the other Cybele, in a dejected attitude, holding in her left hand a key, and ſurrounded with animals and growing plants; with this legend, *Deam luctus angit amiſſi*; and beneath, *Poſt obitum Upſaliæ. die* X. *Jan.* M.DCC.LXXVIII. *Rege jubente*.—The ſame generous monarch not only honoured the Royal Academy of Sciences with his preſence when Linnæus's commemoration was held at Stockholm, but, as a ſtill higher tribute, in his ſpeech from the throne to the aſſembly of the ſtates, he lamented Sweden's loſs by his death. Nor was Linnæus honoured only in his own country. The late worthy profeſſor of botany at Edinburgh, Dr Hope, not only pronounced an eulogium in honour of him before his ſtudents at the opening of his lectures in the ſpring 1778, but alſo laid the foundation-ſtone of a monument (which he afterwards erected) to his memory, in the botanic garden there; which, while it perpetuates the name and merits of Linnæus, will do honour to the founder, and, it may be hoped, prove the means of raiſing an emulation favourable to that ſcience which this illuſtrious Swede ſo highly dignified and improved.

As to the private and perſonal character of this illuſtrious philoſopher: His ſtature was diminutive and puny; his head large, and its hinder part very high; his look was ardent, piercing, and apt to daunt the beholder; his ear not ſenſible to muſic; his temper quick, but eaſily appeaſed.

Nature had, in an eminent manner, been liberal in the endowments of his mind. He ſeems to have been poſſeſſed of a lively imagination, corrected however by a ſtrong judgment, and guided by the laws of ſyſtem. Add to theſe, the moſt retentive memory, an unremitting induſtry, and the greateſt perſeverance in all his purſuits; as is evident from that continued vigour with which he proſecuted the deſign, that he appears to have formed ſo early in life, of totally reforming and fabricating anew the whole ſcience of natural hiſtory; and this fabric he raiſed, and gave to it a degree of perfection unknown before; and had moreover the uncommon felicity of living to ſee his own ſtructure riſe above all others, notwithſtanding every diſcouragement its author at firſt laboured under, and the oppoſition it afterwards met with. Neither has any writer more cautiouſly avoided that common error of building his own fame on the ruin of another man's. He every where acknowledged the ſeveral merits of each author's ſyſtem; and no man appears to have been more ſenſible of the partial defects of his own. Thoſe anomalies which had principally been the objects of criticiſm, he well knew every artificial arrangement muſt abound with; and having laid it down as a firm maxim, that every ſyſtem muſt finally reſt on its intrinſic merit, he willingly commits his own to the judgment of poſterity. Perhaps there is no circumſtance of Linnæus's life which ſhows him in a more dignified light than his conduct towards his opponents. Diſavowing controverſy, and juſtly conſidering it as an unimportant and fruitleſs ſacrifice of time, he never replied to any, numerous as as they were at one ſeaſon.

To all who ſee the aid this extraordinary man has brought to natural ſcience, his talents muſt appear in a very illuſtrious point of view; but more eſpecially to thoſe who, from ſimilarity of taſte, are qualified to ſee more diſtinctly the vaſt extent of his original deſign, the greatneſs of his labour, and the elaborate execution he has given to the whole. He had a happy command of the Latin tongue, which is alone the language of ſcience; and no man ever applied it more ſucceſsfully to his purpoſes, or gave to deſcription ſuch copiouſneſs, united with that preciſion and conciſeneſs which ſo eminently characteriſe his writings.

The ardour of Linnæus's inclinations to the ſtudy of nature, from his earlieſt years, and that uncommon application which he beſtowed upon it, gave him a moſt comprehenſive view both of its pleaſures and uſefulneſs, at the ſame time that it opened to him a wide field hitherto but little cultivated, eſpecially in his own country. Hence he was early led to regret, that the ſtudy of natural hiſtory, as a public inſtitution, had not made its way into the univerſities; in many of which, logical diſputations and metaphyſical theories had too long prevailed, to the excluſion of more uſeful ſcience. Availing himſelf therefore of the advantages which he derived from a large ſhare of eloquence, and an animated ſtyle, he never failed to diſplay, in a lively and convincing manner, the relation this ſtudy hath to the public good; to incite the great to countenance and to protect it; to encourage and allure youth into its purſuits, by opening its manifold ſources of pleaſure to their view, and ſhowing them how greatly this agreeable employment would add, in a variety of inſtances, both to their comfort and emolument. His extenſive view of natural hiſtory, as connected with almoſt all the arts of life, did not allow him to confine theſe motives and incitements to thoſe only who were deſigned for the practice of phyſic. He alſo laboured to inſpire the great and opulent with a taſte for this ſtudy; and wiſhed particularly that ſuch as were devoted to an eccleſiaſtic life ſhould ſhare a portion of natural ſcience; not only as a means of ſweetening their rural ſituation, confined, as many are, perpetually to a country reſidence, but as what would almoſt inevitably lead, in a variety of inſtances, to diſcoveries which only ſuch ſituations would give riſe to, and which the learned in great cities could have no opportunities to make. Not to add, that the mutual communication and enlargement of this kind of knowledge among people of equal rank in a country ſituation, muſt prove one of the ſtrongeſt bonds of union and friendſhip, and contribute, in a much higher degree than the uſual periſhing amuſements of the age, to the pleaſures and advantage of ſociety.

Linnæus lived to enjoy the fruit of his own labour in an uncommon degree. Natural hiſtory raiſed itſelf in Sweden, under his culture, to a ſtate of perfection unknown elſewhere; and was from thence diſſeminated through all Europe. His pupils diſperſed themſelves over all the globe; and with their maſter's fame, extended both ſcience and their own. More than this, he lived to ſee the ſovereigns of Europe eſtabliſh ſeveral public inſtitutions in favour of this ſtudy; and even profeſſorſhips eſtabliſhed in divers univerſities for the ſame purpoſe, which do honour to their founders and patrons, and which have excited a curioſity for the ſcience, and a ſenſe of its worth, that cannot fail to further its progreſs, and in time raiſe it to that rank which it is entitled to hold among the purſuits of mankind.

LINNET, in ornithology. See Fringilla. It is remarkable of this bird, that when it builds in hedges, and when in furze-buſhes on heaths, in both which places the neſts are very common, they are made of very different materials. When they build in hedges, they uſe the ſlender-filaments of the roots of trees, and the down of feathers and thiſtles; but when they build on heaths, they uſe moſs, principally for the other part, finiſhing it within with ſuch things as the place will afford. Theſe birds will have young ones three or four times a-year, eſpecially if they are taken away before they are able to leave the neſts.

When linnets are to be taught to whiſtle tunes, or to imitate the notes of any other bird, they muſt be taken from the old one when they are not above four days old; for at this time they have no idea of the note of the old ones, and will be readily taught to modulate their voice like any thing that is moſt familiar to their ears, and within the compaſs of their throats. More care is required in feeding them when taken thus young, than when they are left in the neſt till nearly fledged; but they will be reared very well upon a food half bread and half rapeſeed boiled and bruiſed: this muſt be given them ſeveral times a-day. It muſt be made freſh every day, and given them ſufficiently moiſt, but not in the extreme. If it be in the leaſt ſour, it gripes and kills them; and if too ſtiff, it is as miſchievous by binding them up.—They muſt be hung up as ſoon as taken from the neſt, under the bird whoſe note they are intended to learn; or, if they are to be taught to whiſtle tunes, it muſt be done by giving them leſſons at the time of feeding; for they will profit more, while young, in a few days, than in a long time afterwards, and will take in the whole method of their notes before they are able to crack hard ſeeds. Some have attempted to learn them to ſpeak in the manner of the parrot or other birds; and they will arrive at ſome ſort of perfection in it, with great pains.

LINSEED, the ſeed of the plant linum.—Linſeed ſteeped and bruiſed in water gives it very ſoon a thick mucilaginous nature, and communicates much of its emollient virtue to it. See Linum.

LINT. See Flax, Linen, and Linum.

Lint, in ſurgery, is the ſcrapings of fine linen, uſed by ſurgeons in dreſſing wounds. It is made into various forms, which acquire different names according to the difference of their figures.—Lint made up in an oval or orbicular form is called a *pledgit*; if in a cylindrical form, or in ſhape of a date, or olive-ſtone, it is called a *doſſil*.

Theſe different forms of lint are required for many purpoſes; as, 1. To ſtop blood in freſh wounds, by filling them up with dry lint before the application of a bandage: though, if ſcraped lint be not at hand, a piece of fine linen may be torn into ſmall rags, and applied in the ſame manner. In very large hæmorrhages the lint or rags ſhould be firſt dipped in ſome ſtyptic liquor, as alcohol, or oil of turpentine: or ſprinkled with ſome ſtyptic powder. 2. To agglutinate or heal wounds; to which end lint is very ſerviceable, if ſpread with ſome digeſtive ointment, balſam, or vulnerary liquor. 3. In drying up wounds and ulcers, and forwarding the formation of a cicatrix. 4. In keeping the lips of wounds at a proper diſtance, that they may not haſtily unite before the bottom is well digeſted and healed. 5. They are highly neceſſary to preſerve wounds from the injuries of the air.——Surgeons of former ages formed compreſſes of ſponge, wool, feathers, or cotton; linen being ſcarce: but lint is far preferable to all theſe, and is at preſent univerſally uſed.

LINTERNUM, or Literum, (anc. geog.), a city of Campania, ſituated at the mouth of the Clanius, which is alſo called Liturnus, between Cumæ and

Vulturnum. It received a Roman colony at the ſame time with Puteoli and Vulturnum; was improved and enlarged by Auguſtus; afterwards forfeited its right of colonyſhip, and became a prefecture. Hither Scipio Africanus the Elder retired from the mean envy of his ungrateful countrymen; and here he died, and was buried: though this laſt is uncertain, he having a monument both here and at Rome. No veſtige of the place now remains.

LINTSTOCK, in military affairs, a wooden ſtaff about three feet long, having a ſharp point in one end and a ſort of a fork or crotch on the other; the latter of which ſerves to contain a lighted match, and by the former the lintſtock is occaſionally ſtuck in the ground, or in the deck of a ſhip during an engagement. It is very frequently uſed in ſmall veſſels, where there is commonly one fixed between every two guns, by which the match is always kept dry, and ready for firing.

LINTZ, a very handſome town of Germany, and capital of Upper Auſtria, with two fortified caſtles; the one upon a hill, the other below it. Here is a hall in which the ſtates aſſemble, a bridge over the Danube, a manufacture of gunpowder, and ſeveral other articles. It was taken by the French in 1741, but the Auſtrians retook it in the following year. E. Long. 14. 33. N. Lat. 48. 16.

Lintz, a town of Germany, in the circle of the Lower Rhine, and Electorate of Cologne, ſubject to that elector. It is ſeated on the river Rhine, in E. Long. 7. 1. N. Lat. 50. 31.

LINUM, Flax; a genus of the pentagynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 14th order, *Gruinales*. The calyx is pentaphyllous; the petals are five, the capſule is quinquevalved and decemlocular; and the ſeeds are ſolitary.

Species. 1. The uſitatiſſimum, or common annual flax, hath a taper fibrous root; upright, ſlender, unbranched ſtalks, two feet and a half high; garniſhed with narrow, ſpear-ſhaped, alternate grey-coloured leaves; and the ſtalks divided into footſtalks at top, terminated by ſmall blue crenated flowers in June and July; ſucceeded by large round capſules of ten cells, containing each one ſeed. 2. The perenne, or perennial Siberian flax, hath a fibrous perennial root, ſending up ſeveral upright, ſtrong, annual ſtalks, branching four or five feet high; garniſhed with ſmall narrow, ſpear-ſhaped, alternate leaves of a dark green colour; and terminated by umbellate cluſters of large blue flowers in June, ſucceeded by ſeeds in autumn. 3. The catharticum, or purging flax, with leaves oppoſite and lanceolate; the ſtem bifurcated, and the corolla acute. This is a very ſmall plant, not above four or five inches high; found wild upon chalky hills and in dry pleaſure-grounds. There are 18 other ſpecies.

Culture. The firſt ſpecies is cultivated in the fields according to the directions given under the article Flax. The ſecond ſort is raiſed from ſeed in a bed or border of common garden-earth, in ſhallow drills ſix inches aſunder; and when the plants are two or three inches high, thin them to the ſame diſtance; and in autumn plant them out where they are wanted.

Uſes. The firſt ſpecies may juſtly be looked upon as one of the moſt valuable of the whole vegetable kingdom; as from the bark of its ſtalks is manufactured the lint or flax for making all ſorts of linen-cloth; from the rags of the linen is made paper; and from the ſeeds is expreſſed the lintſeed oil ſo uſeful in painting and other trades. The ſeeds themſelves are eſteemed an excellent emollient and anodyne: they are uſed externally in cataplaſms, to aſſuage the pain of inflamed tumors: internally, a ſlight infuſion of linſeed, by way of tea, is recommended in coughs as an excellent pectoral, and of great ſervice in pleuriſies, nephritic complaints, and ſuppreſſions of urine. The virtue of the third ſpecies is expreſſed in its title: an infuſion in water or whey of a handful of the freſh leaves, or a dram of them in ſubſtance when dried, are ſaid to purge without inconvenience.

LINUS, in claſſical hiſtory, a native of Colchis, cotemporary with Orpheus, and one of the moſt ancient poets and muſicians of Greece. It is impoſſible, at this diſtance of time, to diſcover whether Linus was the diſciple of Orpheus, or Orpheus of Linus. The majority, however, ſeem to decide this queſtion in favour of Linus. According to archbiſhop Uſher, he flouriſhed about 1280 B. C. and he is mentioned by Euſebius among the poets who wrote before the time of Moſes. Diodorus Siculus tells us, from Dionyſius of Mitylene the hiſtorian, who was cotemporary with Cicero, that Linus was the firſt among the Greeks who invented verſes and muſic, as Cadmus firſt taught them the uſe of letters. The ſame writer likewiſe attributes to him an account of the exploits of the firſt Bacchus, and a treatiſe upon Greek mythology, written in Pelaſgian characters, which were alſo thoſe uſed by Orpheus, and by Pronapides the preceptor of Homer. Diodorus ſays that he added the ſtring *lichanos* to the Mercurian lyre; and aſcribes to him the invention of rhime and melody; which Suidas, who regards him as the moſt ancient of lyric poets, confirms. Mr Marpurg tells us, that Linus invented cat-gut ſtrings for the uſe of the lyre, which, before his time, was only ſtrung with thongs of leather, or with different threads of flax ſtrung together. He is ſaid by many writers to have had ſeveral diſciples of great renown; among whom were Hercules, Thamyris, and, according to ſome, Orpheus.—Hercules, ſays Diodorus, in learning from Linus to play upon the lyre, being extremely dull and obſtinate, provoked his maſter to ſtrike him; which ſo enraged the young hero, that, inſtantly ſeizing the lyre of the muſician, he beat out his brains with his own inſtrument.

LION, in zoology. See Felis.

LIONCELLES, in heraldry, a term uſed for ſeveral lions borne in the ſame coat of arms.

LIOTARD, called the *Turk*, an eminent painter, was born at Geneva in 1702, and by his father was deſigned for a merchant; but by the perſuaſion of his friends, who obſerved the genius of the young man, he was permitted to give himſelf up to the art of painting. He went to Paris in 1725, and in 1738 accompanied the marquis de Puiſieux to Rome, who was going ambaſſador to Naples. At Rome he was taken notice of by the earls of Sandwich and Beſborough, then lord Duncannon, who engaged Loitard to go with them on a voyage to Conſtantinople. There he became acquainted with the late lord Edgecumbe, and Sir Everard Fawkener, Engliſh ambaſſador, who perſuaded him to come to England, where he ſtaid two years. In his journey to the Levant he had adopted the eaſtern habit, and wore it there with a very long beard. It contributed much to the portraits of himſelf, and ſome thought to draw cuſtomers; but he was really a painter of uncommon merit. After his return to the continent, he married a young wife, and ſacrificed his beard to Hymen. He came again to England in 1772, and brought a collection of pictures of different maſters, which he ſold by auction, and ſome pieces of glaſs painted by himſelf, with ſurpriſing effect of light and ſhade, but a mere curioſity, as it was neceſſary to darken the room before they could be ſeen to advantage; he affixed, too, as uſual, extravagant prices to them. He ſtaid there about two years, as in his former journey. He has engraved ſome Turkiſh portraits, one of the empreſs queen and the eldeſt arch-ducheſs in Turkiſh habits, and the heads of the emperor and empreſs. He painted admirably well in miniature; and finely in enamel, though he ſeldom practiſed it. But he is beſt known by his works in crayons. His likeneſſes were as exact as poſſible, and too like to pleaſe thoſe who ſat to him; thus he had great buſineſs the firſt year, and very little the ſecond. Devoid of imagination, and one would think of memory, he could render nothing but what he ſaw before his eyes. Freckles, marks of the ſmall-pox, every thing found its place; not ſo much from fidelity, as becauſe he could not conceive the abſence of any thing that appeared to him. Truth prevailed in all his works, grace in very few or none. Nor was there any eaſe in his out line; but the ſtiffneſs of a buſt in all his portraits. *Walpole.*

LIP, in anatomy. See there, n° 102.

Hare-Lip, a diſorder in which the upper lip is in a manner ſlit or divided ſo as to reſemble the upper lip of a hare, whence the name. See SURGERY.

LIPARA (anc. geog.), the principal of the iſlands called *Æolia*, ſituated between Sicily and Italy, with a cognominal town, ſo powerful as to have a fleet, and the other iſlands in ſubjection to it. According to Diodorus Siculus, it was famous for excellent harbours and medicinal waters. He informs us alſo, that it ſuddenly emerged from the ſea about the time of Hannibal's death. The name is Punic, according to Bochart: and given it, becauſe, being a volcano, it ſhone in the night. It is now called *Lipari*, and gives name to nine others in its neighbourhood; viz. Stromboli, Pare, Rotto, Panaria, Saline, Volcano, Fenicuſa, Alicor, and Uſtica. Theſe are called, in general, the *Lipari Iſlands*. Some of theſe are active volcanoes at preſent, though Lipari is not. It is about 15 miles in circumference; and abounds in corn, figs, and grapes; bitumen, ſulphur, alum, and mineral waters.

LIPARI, an ancient and very ſtrong town, and capital of an iſland of the ſame name in the Mediterranean, with a biſhop's ſee. It was ruined by Barbaroſſa in 1544, who carried away all the inhabitants into ſlavery, and demoliſhed the place; but it was rebuilt by Charles V. E. Long. 15. 30. N. Lat. 28. 35.

Lipari, properly, is the general name of a cluſter of iſlands. Theſe, according to Mr Houel, are principally ten in number, the reſt being only uninhabitable rocks of narrow extent. The largeſt and the moſt populous of them, that abovementioned, communicates its name to the reſt. *Volcano* is a deſert but habitable iſland, lying ſouth from the large iſland of Lipari. *Salines*, which lies weſt-north-weſt from the ſame iſland; *Felicudi*, nearly in the ſame direction, but twenty miles father diſtant; and *Alcudi*, ten miles ſouth-weſt of Felicudi; are inhabited. *Pannari* is eaſt of Lipari, the famous *Stromboli* north-eaſt, and both of them are inhabited. The reſt are in a deſart ſtate; ſuch as *Bazilazzo*, which was formerly inhabited; *Attalo*, which might be inhabited; and *L'Exambianca*, on which ſome remains of ancient dwellings are ſtill to be found. *L'Eſcanera* is nothing but a bare rock.

The *Fermicoli*, a word ſignifying *ants*, are a chain of ſmall black cliffs which run to the north-eaſt of Lipari, till within a little way of L'Exambianca and Eſcanera, riſing more or leſs above the water, according as the ſea is more or leſs agitated.

Ancient authors are not agreed with reſpect to the number of the Lipari iſlands. Few of thoſe by whom they are mentioned appear to have ſeen them: and in places ſuch as theſe, where ſubterraneous fires burſt open the earth and raiſe the ocean from its bed, terrible changes muſt ſometimes take place. *Volcanella* and *Volcano* were once ſeparated by a ſtrait ſo as to form two iſlands. The lava and aſhes have filled up the intervening ſtrait; and they are now united into one iſland, and have by this change become much more habitable.

The caſtle of Lipari ſtands on a rock on the eaſt quarter of the iſland. The way to it from the city leads up a gentle declivity. There are ſeveral roads to it. This caſtle makes a part of the city; and on the ſummit of the rock is the citadel, in which the governor and the garriſon reſides. The cathedral ſtands in the ſame ſituation. Here the ancients, in conformity to their uſual practice, had built the temple of a tutelary god. The citadel commands the whole city; and it is acceſſible only at one place. Were an hoſtile force to make a deſcent on the iſland, the inhabitants might retreat hither, and be ſecure againſt all but the attacks of famine.

The ancient inhabitants had alſo fortified this place. Conſiderable portions of the ancient walls are ſtill ſtanding in different places, particularly towards the ſouth: their ſtructure is Grecian; and the ſtones are exceedingly large, and very well cut. The layers are three feet high, which ſhows them to have been raiſed in ſome very remote period. Theſe remains are ſurrounded with modern buildings. The remains of walls, which are ſtill to be ſeen here, have belonged not only to temples, but to all the different ſorts of buildings which the ancients uſed to erect. The vaults, which are in a better ſtate of preſervation than any of the other parts of theſe monuments, are now converted to the purpoſes of a priſon.

In the city of Lipari there are convents of monks of two different orders; but there are no convents for women, that is to ſay, no cloiſters in which women are confined; thoſe, however, whoſe heads and hearts move them to embrace a ſtate of pious celibacy, are at liberty to engage in a monaſtic life, with the concurrence of their confeſſors. They put on the ſacred habit, and vow perpetual virginity, but continue to live with their father and mother, and mix in ſociety like other women. The vow and the habit even enlarge their liberty. This cuſtom will, no doubt, M. Houel obſerves, appear very ſtrange to a Frenchwoman ; but this was the way in which the virgins of the primitive church lived. The idea of ſhutting them up together did not occur till the fifth century. The life of theſe religious ladies is leſs gloomy than that which thoſe under the ſame vows lead in other countries. They wear cloaths of particular colours, according as they belong to this or that order. Their dreſs gives them a right to frequent the church at any hours ; and the voice of cenſure, which takes particular pleaſure in directing her attacks againſt pious ladies, goes ſo far as to aſſert, that ſome young women aſſume the habit with no other views but that they may enjoy greater freedom.

In this iſland oxen of a remarkably beautiful ſpecies are employed in ploughing the ground. The ancient plough is ſtill in uſe here. The mode of agriculture practiſed here is very expeditious. One man traces a furrow, and another follows to ſow in it grain and pulſe. The ploughman, in cutting the next furrow, covers up that in which the ſeed has been ſown : and thus the field is both ploughed and ſown at once. Nature ſeems to be here uncommonly vigorous and fertile. Vegetation is here more luxuriant, and animals gayer and more healthful, than almoſt any where elſe.

Near the city of Lipari, the traveller enters deep narrow roads, of a very ſingular appearance. The whole iſland is nothing but an aſſemblage of mountains, all of them conſiſting of aſhes or lava diſcharged from the depths of the volcano by which it was at firſt produced. The particles of this puzzolana, or aſhes, are not very hard ; the action of the rain-water has accordingly cut out trenches among the mountains ; and theſe trenches being perhaps leſs uneven than the reſt of the ſurface, have of conſequence been uſed as roads by the inhabitants, and have been rendered much deeper by being worn for ſo many ages by the feet of men and other animals. Theſe roads are more than five or ſix fathoms deep, and not more than ſeven or eight feet wide. They are very crooked, and have echoes in ſeveral places. You would think that you were walking through narrow ſtreets without doors or windows. Their depth and windings ſhelter the traveller from the ſun while he is paſſing through them ; and he finds them deliciouſly cool.

The firſt volcanic eruption in the Lipari iſlands, mentioned in hiſtory, is that of which Callias takes notice of in his hiſtory of the wars in Sicily. Callias was contemporary with Agathocles. That eruption continued without interval for ſeveral days and nights ; and threw out great ſtones, which fell at more than a mile's diſtance. The ſea boiled all around the iſland. The works of Callias are loſt, and we know not whether he deſcended to a detail of particulars concerning the ravages produced by this eruption. Under the conſulſhip of Æmilius Lepidus and L. Aurelius Oreſtes, 126 years before the Chriſtian era, theſe iſlands were affected with a dreadful earthquake. The burning of Ætna was the firſt cauſe of that. Around Lipari and the adjacent iſlands, the air was all on fire. Vegetation was withered ; animals died ; and fuſible bodies, ſuch as wax and reſin, became liquid. If the inhabitants of Lipari, from whom our author received theſe facts, and the writers who have handed down an account of them, have not exaggerated the truth, we muſt believe that the ſea then boiled round the iſland ; the earth became ſo hot as to burn the cables by which veſſels were fixed to the ſhore, and conſumed the planks, the oars, and even the ſmall boats.

Pliny, the naturaliſt*, ſpeaks of another ſimilar event which happened 30 or 40 years afterwards, in the time of the war of the allied ſtates of Italy againſt Rome. One of the Eolian iſlands, ſays he, was all on fire as well as the ſea ; and that prodigy continued to appear till the ſenate appeaſed, by a deputation, the wrath of the gods. From the time of that war, which happened 86 years before the birth of our Saviour, till the year 144 of our era, we have no account of any eruption of theſe volcanoes ; and from that period again, till the year 1444, we hear of no exploſion from them, that is, for the ſpace of 1300 years. But, at that time, both Sicily and the Eolian iſles were agitated by dreadful ſhocks of earthquake : the volcano of theſe iſles poured forth ſtreams of lava with an awful violence, and emitted a volume of flame and ſmoke which roſe to an amazing height. After that it diſcharged enormous ſtones which fell at the diſtance of more than ſix miles.

A century later, in the year 1550, the fury of this volcano was again renewed. The aſhes and ſtones diſcharged from the crater filled up the ſtrait between Volcano and Volcanello.

About two centuries after that, in the year 1739, there was a ſixth eruption. The burſtings of the volcanic fire were attended with a noiſe ſo dreadful, that it was heard as far as Melazzo in Sicily.

Father Leandro Alberti ſays, that on one of thoſe dreadful occaſions, the women of Lipari, after employing in vain all the ſaints, vowed to drink no more wine if the volcano ſhould ſpare them. Their giving up this ſmall gratification was doubtleſs of great ſervice ; yet the eruptions ſtill continue, and have even become more frequent ſince that time. Only 36 years intervened between this eruption and that which happened in the year 1775. The whole iſland was then ſhaken ; ſubterraneous thunder was heard ; and conſiderable ſtreams of flame, with ſmoke, ſtones, and vitreous lava, iſſued from the crater. Lipari was covered over with aſhes ; and part of theſe was conveyed by the winds all the way into Sicily. Five years after, however, in the month of April 1780, there iſſued a new exploſion from Volcano ; the ſmoke was thick, the ſhocks conſtant, and the ſubterraneous noiſe very frequent. So great was the conſternation among the inhabitants of Lipari on this occaſion, that the commander Deodati Dolomieu, who viſited theſe iſlands not long after that event, informs us, that the inhabitants in general, but eſpecially the women, devoted themſelves as ſlaves to the ſervice of the bleſſed virgin ; and wore on their arms, as tokens of their ſervitude, ſmall iron chains, which they ſtill continue to wear.

This act of piety, however, was not ſo efficacious as the deputation of the ſenate had been. For after that deputation, more than 200 years paſſed before the Eolian iſles were afflicted by any other eruption, at leaſt by any conſiderable one : whereas, in three years after the ladies devoted themſelves in ſo ſubmiſſive a manner to the ſervice of the virgin, the iſles of Lipari

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* *Lib.* ii. *cap.* 106.

pari were agitated anew by that fatal earthquake which ravaged Calabria, and part of Sicily, on the 5th of February 1783.

The dry baths of St Calogero, in the iſland of Lipari, are ſtoves, where ſulphureous exhalations, known to be of a ſalutary nature, aſcend out of the earth by holes or ſpiracles. A range of apartments are built around the place where the exhalations ariſe. The heat is communicated through thoſe apartments in ſuch a way, that when entering at one end, you advance towards the other, the heat ſtill increaſes upon you till you gain the middle apartment, and again diminiſhes in the ſame manner as you proceed from the middle to the other end of the range of chambers. In conſequence of this diſpoſition of theſe apartments, the ſick perſon can make choice of that temperature which beſt ſuits the nature of his diſeaſe. There are a few miſerable huts and a ſmall chapel for the accommodation of the people who repair to theſe baths. The people of the place are ready to attend them. Phyſicians likewiſe follow their patients thither, when the diſeaſe is of ſuch a nature as to render their attendance requiſite, and the patient rich enough to afford them handſome fees: but there is no phyſician ſettled in the place. Beſides theſe dry baths, there are baths of hot water diſtinguiſhed by the name of *St Calogero's baths*. There are around them buildings ſufficient to lodge a conſiderable number of ſick people with their neceſſary attendants. At preſent, however, thoſe buildings are but in bad condition.

The baths conſiſt of two halls; one ſquare, the other round. The former is antique; it has been built by the Romans; it is arched with a cupola, and 12 feet in diameter; it has been repaired: The other is likewiſe arched with a cupola both within and without. The water comes very hot into the firſt. It guſhes up from among pieces of lava, which compoſe a part of the mountain at the foot of which theſe baths are built. Thoſe ſtones remain in their natural ſtate. All that has been done is the raiſing of a ſquare building incloſing them. Within that building the ſick perſons either ſit down on the ſtones, or immerſe themſelves in the intervening cavities which are filled with water. They continue there for a certain time, and approach nearer to, or remain at a farther diſtance from, the ſpring, according as their phyſician directs. The place ſerves alſo as a ſtove. The hot vapours ariſing from the water communicate to the ſurrounding atmoſphere a conſiderable degree of heat. It is indeed not inferior to that of the hot baths of Termini, which owe their heat to a ſimilar cauſe. In theſe baths, therefore, a perſon can have the benefit either of bathing in the hot water, or of expoſing himſelf to the vapour, the heat of which is more moderate. The bath before mentioned, under the appellation of *dry bath,* is alſo a ſtove; but the hot vapour with which it is filled iſſues directly from the volcano. The place of the bath is, however, at ſuch a diſtance from the volcanic focus, that the heat is not at all intolerable.

The mountain at the foot of which theſe baths are ſituated is round, and terminates at the ſummit in a rock of petrified aſhes, which are very hard and of a very fine grain. This petrification conſiſts of pretty regular ſtrata, and appears to have been greatly prior in its origin to the adjacent rocks; which conſiſt likewiſe of aſhes, but aſhes that have been depoſited at a much later period. From this rock there proceeds likewiſe a ſtream of hot water, by which ſome mills in the neighbourhood are moved.

It cannot but appear ſurpriſing, that nature has placed nearly on the ſummit of a volcanic mountain ſprings which ſupply ſo conſiderable a quantity of water. To account for ſuch a phenomenon would be well worthy of ſome ingenious naturaliſt. Nor are theſe hot ſprings all; proceeding around the ſame hill, at about a mile's diſtance, we find a ſpring of cold water, which originates from the ſummit of the ſame rock; that on the north-weſt produces three hot ſprings. The cold water is very pleaſant to drink, and much uſed both by men and cattle.

Among theſe mountains there are many enormous looſe maſſes of lava, the appearance of which, M. Houel informs us, naturally leads the obſerver to take notice that the lava of the volcano of Lipari is of a much greater diverſity of colours, and thoſe richer and more lively, than the lava of Veſuvius and Etna. The lava of Lipari is in ſome places, for ſeveral miles, of a beautiful red colour. It contains likewiſe in great abundance ſmall black cryſtalliſed ſcoriæ, as well as the ſmall white grains which are commonly found in lava.

Among the eminences which overlook the city of Lipari, there are ſome rocks of a ſpecies which is very rare in Europe. Thoſe are large maſſes of vitrified matter, which riſe ſix or eight feet above the ſurface of the ground, and appear to extend to a great depth under it. They exiſt, through that range of mountains, in enormous maſſes, mixed with lavas of every different colour, and always ſtanding detached and inſulated. Were they cut and followed under ground, they would probably be found to exiſt in immenſe quarries in the bowels of the earth. The glaſs of which they conſiſt might be employed with great advantage in manufactures. It is ready made, and might be eaſily purified. It is green, compact, and tranſparent.

The cultivation of the ground is the chief employment of the inhabitants of Lipari. The poſſeſſion of a few acres of land here gives a man great importance. Parents, when they ſettle their children, rather give them money than any part of their lands.

More than two-thirds of the iſland is planted with vines: three-fourths of the grapes which theſe produce are dried, and ſent moſtly to London under the name of *Paſſola*. There are different ſorts of paſſola; one of theſe, called the *black paſſolina,* is prepared from a particular kind of grape, of which the berries are uncommonly ſmall; and ſold to Marſeilles, Holland, and Trieſte. The vines are in ſmall arbours, which riſe only to the height of two feet and an half above the ground. Under thoſe arbours there grow beans, gourds, and other leguminous vegetables. In ſo hot a climate, the ſhade of the vines does not injure but protect the vegetables growing under it: they would otherwiſe be withered by the heat of the ſun.

The method of preparing paſſola and paſſolina is curious enough: They firſt make a lixivium of common aſhes; after boiling this, they paſs it through a cloth or a ſieve; they then put it again on the fire; and when it is obſerved to boil hard, ſuddenly immerſe the grapes, but inſtantly bring them out again, and expoſe them to the ſun to dry on broad frames of cane. When ſufficiently dry, the raiſins are put into caſks and barrels to be ſold and exported. The number of caſks of different ſorts of raiſins annually exported from Lipari are eſtimated at 10,000.

This iſland likewiſe produces figs. There is ſome white malmſey and a little red wine exported from it.

About 60 or 80 years ſince, ſulphur was one of the articles with which the inhabitants of this iſland ſupplied foreign merchants. But that trade has been given up; from an idea which the Lipareſe entertain, that ſulphur infects the air ſo as to injure the fertility of the vines. The ſame prejudice prevails in Sicily; but it ſeems to be ill-founded.

There are courts of juſtice in Lipari, of the ſame powers and character with thoſe in the cities of Sicily. Cauſes of more than ordinary importance are carried to Palermo.

The iſland is entirely free from every kind of impoſition. The king receives nothing from it; becauſe Count Roger anciently beſtowed on its biſhop all his rights of royalty over Lipari. The biſhop there received annually from the inhabitants a tenth part of the products of their lands. They afterwards to prevent fraud, eſtimated the value of that tithe for one year; and on the condition of their paying in future a ſum of money equal to what that year's tithe was valued at, he not only gave up his right to the tithe, but alſo ceded to them a conſiderable extent of land which belonged to him.

In the archiepiſcopal palace, and in the palace of the Baron de Monizzio, there are ſome noble pieces of painting by Sicilian painters:—A St Peter, a St Roſalia, Jeſus diſputing with the Jewiſh doctors, the adulterous woman, the incredulity of St Thomas.

LIPOTHYMIA, FAINTING, may ariſe from ſeveral cauſes; as too violent exerciſe, ſuppreſſion of the menſes, or other accuſtomed evacuations, &c. See (the *Index* ſubjoined to) MEDICINE.

LIPPA, a town of Hungary, with a caſtle. It was taken by the Turks in 1552; by the Imperialiſts in 1688; and by the Turks again in 1691; who abandoned it in 1695, after having demoliſhed the fortifications. It is ſeated on a mountain, in E. long. 21. 55. N. lat. 36. 5.

LIPPE, the capital of a country of the ſame name in Germany, and in the circle of Weſtphalia. It is ſeated on a river of the ſame name, and was formerly the reſidence of the principal branch of the houſe of Lippe. It is now in the poſſeſſion of the king of Pruſſia, and carries on a good trade in preparing timber for building veſſels on the Rhine, with which it has a communication by the river Lippe. The country round it is unwholeſome and marſhy. E. long. 8. 12. N. lat. 51. 43.

LIPPI (Lorenzo), a painter of hiſtory and portraits, was born in 1606, and learned the principles of painting from Matteo Roſelli. He had an exquiſite genius for muſic and poetry, as well as for painting; and in the latter, his proficiency was ſo great that ſome of his compoſitions in the hiſtorical ſtyle were taken for thoſe of Roſelli. However, growing at laſt diſſatisfied with the manner of that maſter, he choſe the manner of Santi di Titi, who was excellent both in deſign and invention, and appeared to have more of ſimple nature and truth in his compoſitions than any other artiſt of that time. At Florence Lippi painted many grand deſigns for the chapels and convents, by which he enlarged his reputation; and at the court of Inſpruck, he painted a great number of portraits of the firſt nobility, which were deſervedly admired. Yet, altho' he was fond of imitating ſimple nature without any embelliſhments from invention, his works are held in the higheſt eſteem for the graceful airs of the heads, for the correctneſs of his outlines, and for the elegant diſpoſition of the figures. He died in 1664.

LIPSIUS (Juſtus), a learned critic, was born at Iſch, a ſmall village near Bruſſels, in 1547. After having diſtinguiſhed himſelf in polite literature, he became ſecretary to cardinal de Granvellan at Rome, where the beſt libraries were open to him; and he ſpent much labour in collating the MSS. of ancient authors. He lived 13 years at Leyden; during which he compoſed and publiſhed what he eſteems his beſt works; but ſettled at Louvain, where he taught polite literature with great reputation. He was remarkable for unſteadineſs in religion, fluctuating often between the Proteſtants and Papiſts; but he became finally a bigotted catholic. He died at Louvain in 1606; and his works are collected in ſix volumes folio.

LIQUEFACTION, an operation by which a ſolid body is reduced into a liquid; or the action of fire or heat on fat and other fuſible bodies, which puts their parts into a mutual inteſtine motion. The liquefaction of wax, &c. is performed by a moderate heat; that of ſal tartari, by the mere moiſture of the air. All ſalts liquefy; ſand, mixed with alkalies, becomes liquefied by a reverberatory fire, in the making of glaſs. In ſpeaking of metals, inſtead of liquefaction, we ordinarily uſe the word *fuſion*.

LIQUID, a body which has the property of fluidity; and beſides that, a peculiar quality of wetting other bodies immerged in it, ariſing from ſome configuration of its particles, which diſpoſes them to adhere to the ſurfaces of bodies contiguous to them. See FLUID.

LIQUID, among grammarians, is a name applied to certain conſonants oppoſed to mutes. Thus l, m, n, and r, are liquids.

LIQUIDAMBAR, SWEET-GUM-TREE, in botany: A genus of the polyandria order, belonging to the monœcia claſs of plants; and in the natural method ranking with thoſe of which the order is doubtful. The male calyx is common, and triphyllous; there is no corolla, but numerous filaments; the female calyces are collected into a ſpherical form, and tetraphyllous; there is no corolla, but ſeven ſtyles; and many bivalved and monoſpermous capſules collected into a ſphere. There are only two ſpecies, both deciduous, *viz.* 1. The ſtyraciflua, or the Virginian or maple-leaved liquidambar; a native of the rich moiſt parts of Virginia and Mexico. It will ſhoot in a regular manner to thirty or forty feet high, having its young twigs covered with a ſmooth, light-brown bark, while thoſe of the older are of a darker colour. The leaves are of a lucid green, and grow irregularly on the young branches, on long footſtalks: They reſemble thoſe of the common maple in figure; the lobes are all ſerrated: and from the baſe of the leaf a ſtrong mid-rib runs to the extremity of each lobe that belongs to it. The flowers are of a kind of ſaffron colour: They are produced at the ends of the branches the beginning of April, and ſometimes ſooner; and are ſucceeded by large round brown fruit, which looks ſingular, but is thought by many to be no ornament to the tree. 2. The peregrinum, Canada liquidambar, or ſpleenwort-leaved gale, is a native of Canada and Pennſylvania. The young branches of this ſpecies are ſlender, tough, and hardy. The leaves are oblong, of a deep green colour, hairy underneath, and have indentures on their edges alternately very deep. The flowers come out from the ſides of the branches, like the former; and they are ſucceeded by ſmall roundiſh fruit, which ſeldom ripens in England.

Propagation. This may be performed either by ſeeds or layers; but the firſt method is the beſt. 1. They receive the ſeeds from America in the ſpring. Againſt their arrival, a fine bed, in a warm well ſheltered place, ſhould be prepared. If the ſoil is not naturally good, and inclined to be ſandy, it ſhould be wholly taken out near a foot deep, and the vacancy filled up with earth taken up a year before from a freſh paſture with the ſward, and all well rotted and mixed by being often turned, and afterwards mixed with a ſixth part of drift or ſea-ſand. A dry day being made choice of, early in March, let the ſeeds be ſown, and the fineſt of this compoſt riddled over them a quarter of an inch deep. When the hot weather in the ſpring comes on, the beds ſhould be ſhaded, and waterings given often, but in very ſmall quantities, often affording them a gentle, nay, a very ſmall ſprinkling, at a time. Miller ſays the ſeeds of theſe plants never come up under two years. But, continues Hanbury, with this eaſy management, I hardly ever knew it longer than the end of May before the young plants made their appearance. The plants being come up, ſhading ſhould ſtill be afforded them in the parching ſummer, and a watering every other night; and this will promote their growth, and cauſe them to become ſtronger plants by the autumn. In the autumn, the beds ſhould be hooped to be covered with mats in the ſevere froſts. Theſe mats, however, ſhould always be taken off in open weather; and this is all the management they will require during the firſt winter. The ſucceeding ſummer they will require no other trouble than weeding; though, if it ſhould prove a dry one, they will find benefit from a little water now and then. By the autumn they will be grown ſtrong enough to reſiſt the cold of the following winter, without demanding the trouble of matting, if the ſituation is well ſheltered; if not, it will be proper to have the hoops prepared, and the mats ready, againſt the black northern froſts, which would endanger at leaſt their looſing their tops. After this, nothing except weeding will be wanted; and in the ſpring following, that is, three years from their firſt appearance, they ſhould be taken up (for they ſhould not be removed before, unleſs ſome of the ſtrongeſt plants be drawn out of the bed), and planted in the nurſery a foot aſunder, and two feet diſtant in the rows. Hoeing the weeds in the rows in the ſummer, and digging them in the winter, is all the trouble they will afterwards occaſion until they are finally planted out. 2. Theſe plants are eaſily increaſed by layers. The operation muſt be performed in the autumn, on the young ſummer's ſhoots; and the beſt way is by ſlitting them at a joint, as is practiſed for carnations. In a ſtrong dry ſoil, they will be often two years or more before they ſtrike root; though, in a fine light ſoil, they will be found to take freely enough. By this method good plants may be obtained; though it is not ſo eligible as the other, if we have the conveniency of procuring the ſeeds.

Properties. The leaves emit their odoriferous particles in ſuch plenty as to perfume the circumambient air; nay, the whole tree exſudes ſuch a fragrant tranſparent reſin, as to have given occaſion to its being taken for the ſweet ſtorax†. Theſe trees, therefore, are very proper to be planted ſingly in large opens, that they may amply diſplay their fine pyramidal growth, or to be ſet in places near ſeats, pavilions, &c. The reſin was formerly of great uſe as a perfume, but is at preſent a ſtranger in the ſhops.

LIQUOR, a name for any fluid ſubſtance of the aqueous or ſpirituous kind.

The principal beverage amongſt the Jews, as well as the Greeks and Romans, in their early ſtate, was water, milk, and the juices of various plants infuſed therein. For a long time, under the commonwealth of Rome, wine was ſo ſcarce, that in their ſacrifices to the gods the libations were made with milk only. Wine did not become common there till A. U. C. 600, when vines began to be planted.

Liquor of Flints. See CHEMISTRY, nº 1069.

Smoking Liquor of Libavius. See CHEMISTRY, nº 810

Mineral Anodyne Liquor of Hoffman. This is a compoſition of highly rectified ſpirit of wine, vitriolic ether, and a little of the dulcified oil of vitriol. It is made by mixing an ounce of the ſpirit of wine, which riſes firſt in the diſtillation of ether, with as much of the liquor which is to be diſtilled, and afterwards by diſſolving in the mixture which riſes next, and which contains the ether, 12 drops of the oil which riſes after the ether is paſſed. This has the ſame virtues with the ether, and is now generally diſuſed, the pure ether being ſubſtituted in its place.

LIQUORICE. See GLYCYRRHIZA.

LIRIODENDRON, the TULIP-TREE, in botany: A genus of the polyginia order, belonging to the polyandria claſs of plants; and in the natural method ranking under the 52d order, *Coadunatæ*. The calyx is triphyllous; there are nine petals; and the ſeeds imbricated in ſuch a manner as to form a cone.——There is but one ſpecies, viz. the *tulipifera*, a deciduous tree, native of moſt parts of America. It riſes with a large upright trunk, branching 40 or 50 feet high. The trunk, which often attains to a circumference of 30 feet, is covered with a grey bark. The branches, which are not very numerous, of the two-years-old wood, are ſmooth and brown; while the bark of the ſummer's ſhoots is ſmoother and ſhining, and of a bluiſh colour. They are very pithy. Their young wood is green, and when broken emits a ſtrong ſcent. The leaves grow irregularly on the branches, on long footſtalks. They are of a particular ſtructure, being compoſed of three lobes, the middlemoſt of which is ſhortened in ſuch a manner that it appears as if it had been cut off and hollowed at the middle: The two others are rounded off. They are about four or five inches long, and as many broad. They are of two colours; their upper ſurface is ſmooth, and of a ſtronger green than the lower. They fall off pretty early in autumn

† See *Styrax.*

tumn; and the buds for the next year's ſhoots ſoon after begin to ſwell and become dilated, inſomuch that, by the end of December, thoſe at the ends of the branches will become near an inch long and half an inch broad. The outward laminæ of theſe leaf-buds are of an oval figure, have ſeveral longitudinal veins, are of a bluiſh colour. The flowers are produced and in July, at the ends of the branches: They ſomewhat reſemble the tulip, which occaſions its being called the Tulip-tree. The number of petals of which each is compoſed, like thoſe of the tulip, is ſix; and theſe are ſpotted with green, red, white, and yellow, thereby making a beautiful mixture. The flowers are ſucceeded by large cones, which never ripen in England.

Propagation. This is very eaſy, if the ſeeds are good; for by theſe, which are received from abroad, they are to be propagated. No particular compoſt need be ſought for; neither is the trouble of pots, boxes, hotbeds, &c. required: They will grow exceedingly well in beds of common garden-mould, and the plants will be hardier and better than thoſe raiſed with more tenderneſs and care. Therefore, as ſoon as you receive the ſeeds, which is generally in February, and a few dry days have happened, ſo that the mould will work freely, ſow the ſeeds, covering them three quarters of an inch deep; and in doing of this, obſerve to lay them lengthwiſe, otherwiſe, by being very long, one part, perhaps that of the embryo plant, may be out of the ground ſoon, and the ſeed be loſt. This being done, let the beds be hooped; and as ſoon as the hot weather and drying winds come on in the ſpring, let them be covered from ten o'clock in the morning till ſun-ſet. If little rain happens, they muſt be duly watered every other day; and by the end of May the plants will come up. Shade and watering in the hotteſt ſummer muſt be afforded them, and they will afterwards give very little trouble. The next winter they will want no other care than, at the approach of it, ſticking ſome furze-buſhes round the bed, to break the keen edge of black froſts; for it is found that the ſeedlings of this ſort are very hardy, and ſeldom ſuffer by any weather. After they have been two years in the ſeed-bed, they ſhould be taken up and planted in the nurſery, a foot aſunder, and two feet diſtant in the rows. After this, the uſual nurſery care of hoeing the weeds, and digging between the rows in the winter, will ſuffice till they are taken up for planting out.

Uſes. The tulip-tree, in thoſe parts of America where it grows common, affords excellent timber for many uſes: particularly, the trunk is frequently hollowed, and made into a canoe ſufficient to carry many people; and for this purpoſe no tree is thought more proper by the natives of thoſe parts. In Europe, it may be ſtationed among trees of forty-feet growth.

LIS, or LYS (John Vander), painter of hiſtory, landſcapes, and converſations, was born at Oldenburgh in 1570, but went to Haerlem to place himſelf as a diſciple under Henry Goltzius; and as he was endowed with great natural talents, he ſoon diſtinguiſhed himſelf in that ſchool, and imitated the manner of his maſter with great ſucceſs. He adhered to the ſame ſtyle till he went to Italy; where, having viſited Venice and Rome, he ſtudied the works of Titian, Tintoretto, Paolo, Veroneſe, and Domenico Fetti, ſo effectually, than he improved his taſte and judgment, and altered his manner entirely. He ſoon received marks of public approbation; and his compoſitions became univerſally admired for their good expreſſion, for their lively and natural colouring, and the ſweetneſs and delicacy of his pencil: although it muſt be acknowledged that he could never totally diveſt himſelf of the ideas and taſte peculiar to the Flemings. His ſubjects uſually were hiſtories taken from the ſacred writings, or the repreſentation of rural ſports, marriages, balls, and villagers dancing, dreſſed in Venetian habits; all which ſubjects he painted in a ſmall as well as a large ſize, with a number of figures, well deſigned, and touched with a great deal of delicacy. He was likewiſe accounted to paint naked figures admirably, with natural and elegant attitudes, and a very agreeable turn of the limbs. A capital picture of this maſter is, Adam and Eve lamenting the death of Abel; which is extremely admired, not only for the expreſſion, but alſo for the beauty of the landſcape: and in the church of St Nicholas at Venice is another of his paintings, repreſenting St Jerom in the deſart, with a pen in his hand, and his head turned to look at an angel, who is ſuppoſed to be ſounding the laſt trumpet. The colouring of this picture is rather too red; but it is deſigned in a fine ſtyle, and charmingly pencilled. The paintings of this maſter are very rarely to be purchaſed. He died in 1629.

Lis (John Vander) of Breda, hiſtorical painter, was born at Breda about the year 1601, and became a diſciple of Cornelius Polemburg, whoſe manner he imitated with extraordinary exactneſs, in the tints of his colouring, his neatneſs of pencilling, and the choice of his ſubjects. Their are ſome paintings of this maſter's hand, which, tho' they appear to have ſomewhat leſs freedom and lightneſs of touch, are nearly equal to thoſe of Polemburg, and are frequently taken to be his. At Rotterdam; in the poſſeſſion of Mr Biſſchop, there is a delicate painting repreſenting Diana in the Bath, attended by her nymphs; and his moſt capital performance, in England, is ſaid to be in the poſſeſſion of the Viſcount Middleton. The portrait of Vander Lis, painted by himſelf, is in the poſſeſſion of Horace Walpole, Eſq. which is deſcribed by that ingenious gentleman, as being worked up equal to the ſmoothneſs of enamel.

LISBON, the capital of the kingdom of Portugal, ſituated in the province of Eſtremadura, on the banks of the river Tagus, in W. Long. 9. 25. N. Lat. 38. 25. It was anciently called *Oliſipo, Oliſippo,* and *Ulyſſipo,* which are ſuppoſed to be derived from the Phenician *Uliſubbo* or *Oliſippo,* ſignifying in that tongue a *pleaſant bay,* ſuch as that on which this city ſtands. It firſt became conſiderable in the reign of king Emmanuel; from that king it hath been the capital of the kingdom, the reſidence of its monarchs, the ſeat of the chief tribunals, and offices of the metropolitan, a noble univerſity, and the receptacle of the richeſt merchandize of the Eaſt and Weſt-Indies. Its air is excellent; being refreſhed by the delightful ſea-breezes, and thoſe of the Tagus. The city extends for about two miles along the Tagus; but its breadth is inconſiderable. Like old Rome, it ſtands on ſeven hills: but the ſtreets in general are narrow and dirty, and ſome of them are very ſteep; neither are they lighted at night. The churches in general, are very fine; but the magnificence of the chapel-royal is amazing. Here is one of the fineſt harbours in the world; and there was a great number not only of fine churches and convents here, but alſo of other public buildings, and particularly of royal palaces, and others belonging to the grandees; but the greateſt part of them, and of the city, were deſtroyed by a moſt dreadful earthquake, on Nov. 1. 1755, from which it will require a long time to recover. The inhabitants, before the earthquake, did not at moſt exceed 150,000. The government of it is lodged in a council, conſiſting of a preſident, ſix counſellors, and other inferior officers. The harbour has water enough for the largeſt ſhips, and room enough for 10,000 ſail without being crowded. For its ſecurity, there is a fort at the mouth of the river, on each ſide, and a bar that runs acroſs it, and is very dangerous to paſs without pilots. Higher up, at a place where the river is conſiderably contracted, there is a fort called *Torre de Belem*, or the *Tower of Belem*, under whoſe guns all ſhips muſt paſs in their way to the city; and on the other ſide are ſeveral more forts. Before the earthquake moſt of the private houſes were old and unſightly, with lattice-windows; and the number of convents and colleges amounted to 50, namely, 32 for monks and 18 for nuns. The king's principal palace ſtands on the river, and is large and commodious. Of the hoſpitals, that called the *Great* is obliged to receive all perſons, of what degree, nation, or religion ſoever, without exception. At the village of Belem, near Liſbon, is a noble hoſpital for decayed gentlemen who have ſerved the king, and have not wherewithal to maintain themſelves. That called the *houſe of mercy* is alſo a noble charity. In the centre of the city, upon one of the higheſt hills, is the caſtle, which commands the whole, being large and ancient, and having always a garriſon of four regiments of foot. The cathedral is a vaſt edifice of the Gothic kind, but heavy and clumſy: it contains, however, great riches, and is finely adorned within. The ſquare called *Roſſio* is large, and ſurrounded with magnificent buildings. The whole city is under the eccleſiaſtical juriſdiction of the patriarch, who was appointed in the year 1717. Here is alſo an archbiſhop, who has, or at leaſt had before the erection of the patriarchate, a revenue of 40,000 cruſadoes, or 6000 l. ſterling. The univerſity, which was removed for ſome time to Coimbra, but afterwards reſtored to its ancient ſeat, makes a conſiderable figure, though much inferior to that of Coimbra.

LISBURN, a town of Ireland, in the county of Antrim and province of Ulſter, 73 miles from Dublin. It was burnt down about 50 years ago; but is now rebuilt in a neat and handſome manner, and has a large linen manufactory. It is ſeated on the river Laggan, in W. Long. 6. 20. N. Lat. 54. 31. It gives title of earl to the family of Vaughan, and it returns two members to parliament; one half of the patronage of this borough being in the earl of Hertford. Fairs held 21ſt of July and 5th October.

LISIEUX, a conſiderable town of France, in Upper Normandy, with a biſhop's ſee. The churches and religious houſes, and the biſhop's palace, are all very handſome ſtructures. It is a trading place; and is ſeated at the confluence of the rivers Arbeck and Gaſſi, in E. Long. 0. 20. N. Lat. 49. 11.

LISLE, a large, rich, handſome, and ſtrong town of French Flanders, of which it is the capital, with a ſtrong caſtle, and a citadel built by Vauban, and ſaid to be the fineſt in Europe, as well as the beſt fortified. The large ſquare, and the public buildings, are very handſome; and they have manufactures of ſilks, cambrics, and camblets, as well as other ſtuffs, which have been brought to great perfection. It was taken by the duke of Marlborough, after three months ſiege and the loſs of many thouſands of men, in 1708; but reſtored to the French by the treaty of Utrecht, in conſideration of their demoliſhing the fortifications of Dunkirk. It is ſeated on the river Duele, 14 miles weſt of Tournay, 32 ſouth-weſt of Ghent, 37 northweſt of Mons, and 130 north of Paris, E. Long. 3. 9. N. Lat. 50. 38.

LISLE (Claudius de), a learned hiſtoriographer, born at Vancouleurs, in 1644. He ſtudied among the Jeſuits at Pont a mouſſon; took his degrees in law, and afterwards applied himſelf intirely to the ſtudy of hiſtory and geography; and to perfect himſelf in thoſe ſciences went to Paris, where the principal lords of the court became his ſcholars, and among the reſt the duke of Orleans, afterwards regent of the kingdom. He wrote, 1. An hiſtorical account of the kingdom of Siam. 2. A genealogical and hiſtorical Atlas. 3. An abridgement of univerſal hiſtory. He died at Paris in 1720.

Lisle (William de), ſon of the former, and the moſt learned geographer France has produced, was born at Paris in 1675. He became firſt geographer to the king, royal cenſor, and member of the academy of ſciences. He died in 1726. He publiſhed a great number of excellent maps, and wrote many pieces in the memoirs of the academy of ſciences.

Lisle (Sir John), a brave loyaliſt in the time of the civil wars, was the ſon of a bookſeller in London, and received his education in the Netherlands. He ſignalized himſelf upon many occaſions in the civil war, particularly in the laſt battle of Newbury; where, in the duſk of the evening, he led his men to the charge in his ſhirt, that his perſon might be more conſpicuous. The king, who was an eye-witneſs of his bravery, knighted him in the field of battle. In 1648, he roſe for his majeſty in Eſſex; and was one of the royaliſts who ſo obſtinately defended Colcheſter, and who died for the defence of it. This brave man having tenderly embraced the corps of Sir Charles Lucas, his departed friend, immediately preſented himſelf to the ſoldiers who ſtood ready for his execution. Thinking that they ſtood at too great a diſtance, he deſired them to come nearer: one of them ſaid, "I warrant you, Sir, we ſhall hit you." He replied with a ſmile, "Friends, I have been nearer you when you have miſſed me." He was executed Auguſt 28th 1648.

LISMORE, one of the Weſtern iſlands of Scotland, ſeated at the mouth of Loch Linnhe, a capacious lake in Argyleſhire, navigable for the largeſt ſhips to Fort William, which ſtands in the country called Lochaber. This iſland is above ſeven miles in length by one in breadth; and contains 1500 inhabitants. It abounds in limeſtone; from which, however, it has hitherto derived little advantage, owing to the want of good peat, the neglect of timber, and ſtill more the duty upon coals. Thus, with the advantages of navigation in every direction, and of a ſoil lying upon the richeſt manure the people are indigent, and frequently obliged to import meal for their ſubſiſtence. Many of them live a part of the year upon milk only. This iſland was formerly the reſidence of the biſhops of Argyle.

LISMORE, a borough, market, fair, and poſt town of Ireland, in the county of Waterford, and province of Munſter, 100 miles from Dublin ; N. Lat. 52. 5. W. Long. 7. 50. It was anciently called *Leſſmore* or *Lois-more*, i. e. the great incloſure, or habitation ; it is now a biſhopric, and formerly had an univerſity. St Carthagh or Mochuda, in the beginning of the ſeventh century founded an abbey and ſchool in this place, which in a ſhort time was much reſorted to, not only by the natives, but alſo by the Britons and Saxons, during the middle ages. According to an ancient writer of the life of St Carthagh, Liſmore was in general inhabited by monks, half of it being an aſylum into which no woman dared to enter; conſiſting entirely of cells and monaſteries, the ruins of which, with ſeven churches, are yet viſible. A caſtle was built here by king John. The ſite of Liſmore was in early ages denominated *magh ſkia*, or the "choſen ſhield," being the ſituation of a dùn or fort of the ancient chieftains of the Decies, one of whom granted it to St Carthagh on his expulſion from the abbey of Ratheny in Weſtmeath. On becoming an univerſity, Math Sgiath obtained the name of *Dunſginne*, or the "fort of the Saxons," from the number of Saxons which reſorted thereto: but ſoon after, it was called *Lois-mor* or *Leſſmore*, and now *Liſmore* ; the biſhopric of which was united to that of Waterford in 1363, being 730 years after its foundation. The public road to Cork was formerly through this place, and at that time it had a better face of buſineſs. St Carthagh, who retired to this place with ſome of his religious in 636, to avoid the fury of the then Iriſh monarch, tied his diſciples to a moſt ſtrict rule of life; they never were allowed the uſe of fleſh, fiſh, or fowl; only the vegetables that the ground produced at the expence of their own labour. Father Daniel, in his *Hiſtoire Monaſtique*, mentions one on the ſame foundation in France. The caſtle here, which as we have formerly mentioned, was built by king John, was erected in 1195 on the ruins of the abbey of St Carthagh ; it belonged to the duke of Devonſhire, and gave birth to that great philoſopher Robert Boyle. In 1289 it was demoliſhed by the Iriſh, who took it by ſurpriſe. Being afterwards reedified, it was for many years an epiſcopal reſidence, till Myler Magrath, archbiſhop of Caſhel, and biſhop of this ſee, granted the manor of Liſmore to that noted ſcholar and ſoldier Sir Walter Raleigh, in the reign of queen Elizabeth, at the yearly rent of L. 13:6:8; but that eſtate was lopped off with his head in the reign of king James I. After which it fell into the hands of Sir Richard Boyle, who purchaſed all Sir Walter's lands; he beautified the whole, and added many buildings to it, moſt of which were burned down in the Iriſh rebellion ; at the breaking out of which, it was cloſely beſieged by 5000 Iriſh, commanded by Sir Richard Beling, and was well defended by the young Lord Broghill, third ſon of the earl of Cork, who obliged them to raiſe the ſiege. The caſtle is boldly ſeated on the verge of a rocky hill, riſing almoſt perpendicularly to a conſiderable height over the river Blackwater. The entrance is by an ancient and venerable avenue of trees. Over the gate are the venerable arms of the firſt earl of Cork. Oppoſite to the entrance is a modern portico of Bath ſtone, of the Doric order, deſigned by Inigo Jones. Moſt of the buildings have remained in ruins ſince the era of the rebellion ; but the ſeveral offices that make up two ſides of the ſquare are kept in repair. At each angle is a tower, the chief remains of its former magnificence. In October 1785, the late duke of Rutland, then lord-lieutenant of Ireland, whilſt on a tour in Munſter, held a council in, and iſſued proclamations from this caſtle. The cathedral is ſtill pretty well kept in repair. Here is a fine bridge over the river Blackwater, erected at a very great expence by the duke of Devonſhire : this bridge is remarkable for the extent of the principal arch, the ſpan of it being 102 feet. Below the town is a rich fiſhery for ſalmon, which is the greateſt branch of trade here. Though this place is at preſent much reduced, yet Cambrenſis informs us, that, not many years after the conqueſt, this was a very rich city, and held out ſome time againſt the Engliſh, who took it at laſt by ſtorm, and gained rich plunder here, enough to load 16 ſail of ſhips. It returns two members to parliament; patron, the duke of Devonſhire, but the electors are called *potwollopers*. Fairs held on 25th May and Septemper, and 12th November.

LISSA, an iſland in the Gulph of Venice, on the coaſt of Dalmatia, belonging to the Venetians, where they have a fiſhery of ſardines and anchovies. It produces excellent wine, and is 70 miles weſt of Raguſa. E. Long. 17. 0. N. Lat. 43. 22.

LISSA, a town of Poland, in the palatinate of Poſna, of which it is the capital. E. Long. 16. 0. N. Lat. 32. 15.

LISSA, a village of Sileſia, 16 miles from Breſlau, remarkable for a battle fought between the Pruſſians and the Auſtrians on the 15th of December 1757, when the latter were entirely defeated.

LISSUS, (anc. geog.), the laſt town of Illyricum, towards Macedonia, ſituated on the Drilo. It had a capacious port, the work of Dionyſius the Tyrant, who led the colony thither, enlarged and walled it round, (Diodorus Siculus.) Now called *Aleſſio*, in Albania, on the Drino, near the Gulph of Venice. E. Long. 20. N. Lat. 42.

LIST, in commerce, the border of cloth or ſtuff; ſerving not only to ſhow their quality, but to preſerve them from being torn in the operations of fulling, dyeing, &c.—Liſt is uſed on various occaſions; but chiefly by gardeners for ſecuring their wall-trees.

LIST, in architecture, a little ſquare moulding, otherwiſe called a *fillet*, *liſtel*, &c. See Plate XXXVIII. fig. 1.

LIST, is alſo uſed, to ſignify the incloſed field or ground wherein the ancient knights held their juſts and combats. It was ſo called, as being hemmed round with pales, barriers, or ſtakes, as with a liſt. Some of theſe were double, one for each cavalier; which kept them apart, ſo that they could not come nearer each other than a ſpear's length. See JUST, TOURNAMENT, DUEL, &c.

Civil **LIST**, in the Britiſh polity. The expences defrayed by the civil liſt are thoſe that in any ſhape relate to civil government ; as, the expences of the houſehold; all ſalaries to officers of ſtate, the judges, and every one of the king's ſervants, the appointments to foreign ambaſſadors; the maintenance of the queen and royal family; the king's private expences, or privy-purſe; and other very numerous outgoings, as ſecret-ſervice money, penſions, and other bounties: which ſometimes have ſo far exceeded the revenues appointed for that purpoſe, that application has been made to parliament to diſcharge the debts contracted on the civil liſt; as particularly in 1724, when one million was granted for that purpoſe by the ſtatute 11 Geo. I. c. 17. and in 1769, when half a million was appropriated to the like uſes by the ſtatute 9 Geo. III. c. 34.

Blackſt. Comment. The civil liſt is indeed properly the whole of the king's revenue in his own diſtinct capacity; the reſt being rather the revenue of the public, or its creditors, though collected and diſtributed again in the name and by the officers of the crown: it now ſtanding in the ſame place, as the hereditary income did formerly; and as that has gradually diminiſhed, the parliamentary appointments have increaſed. The whole revenue of queen Elizabeth did not amount to more than 600,000l. a-year: that of king Char. I. was 800,000l. and the revenue voted for king Charles II. was 1,200,000l. though complaints were made (in the firſt years at leaſt) that it did not amount to ſo much. But it muſt be obſerved, that under theſe ſums were included all manner of public expences; among which Lord Clarendon, in his ſpeech to the parliament, computed, that the charge of the navy and land-forces amounted annually to 800,000l. which was ten times more than before the former troubles. The ſame revenue, ſubject to the ſame charges, was ſettled on king James II.; but by the increaſe of trade, and more frugal management, it amounted on an average to 1,500,000l. *per annum*, beſides other additional cuſtoms granted by parliament, which produced an annual revenue of 400,000l. out of which his fleet and army were maintained at the yearly expence of 1,100,000l. After the revolution, when the parliament took into its own hands the annual ſupport of the forces both maritime and military, a civil-liſt revenue was ſettled on the new king and queen, amounting, with the hereditary duties, to 700,000l. *per annum*; and the ſame was continued to queen Anne and king George I. That of king Geo. II. was nominally augmented to 800,000*l. and in fact was conſiderably more: but that of his preſent majeſty is expreſsly limited to that ſum; tho' 100,000l. hath been ſince added. And upon the whole, it is doubtleſs much better for the crown, and alſo for the people, to have the revenue ſettled upon the modern footing rather than the ancient. For the crown becauſe it is moſt certain, and collected with greater eaſe: for the people; becauſe they are now delivered from the feodal hardſhips, and other odious branches of the prerogative. And though complaints have ſometimes been made of the increaſe of the civil liſt, yet if we conſider the ſums that have been formerly granted, the limited extent under which it is now eſtabliſhed, the revenues and prerogatives given up in lieu of it by the crown, the numerous branches of the preſent royal family, and (above all) the diminution of the value of money compared with what it was worth in the laſt century, we muſt acknowledge theſe complaints to be void of any rational foundation; and that it is impoſſible to ſupport that dignity, which a king of Great Britain ſhould maintain, with an income in any degree leſs than what is now eſtabliſhed by parliament. See Revenue.

* See *Revenue*.

To List, *or enliſt, Soldiers*, to retain and enroll men as ſoldiers, either as volunteers, or by a kind of compulſion. Perſons liſted muſt be carried within four days, but no ſooner than 24 hours after, before the next juſtice of peace of any county, riding, city, or place, or chief magiſtrate of any city or town corporate (not being an officer in the army); and if before ſuch juſtice or magiſtrate they diſſent from ſuch enliſting, and return the enliſting-money, and alſo 20 ſhillings in lieu of all charges expended on them, they are to be diſcharged. But perſons refuſing or neglecting to return and pay ſuch money within 24 hours, ſhall be deemed as duly liſted as if they had aſſented thereto before the proper magiſtrate; and they ſhall, in that caſe, be obliged to take the oath, or, upon refuſal, they ſhall be confined by the officer who liſted them till they do take it.

LISTER (Dr Martin), an eminent Engliſh phyſician and naturaliſt, was born in 1638, and educated at Cambridge. He afterwards travelled into France; and at his return practiſed phyſic at York, and afterwards at London. In 1683, he was created doctor of phyſic, and became fellow of the college of phyſicians in London. In 1698, he attended the earl of Portland in his embaſſy from king William III. to the court of France; of which journey he publiſhed an account at his return, and was afterwards phyſician to queen Anne. He alſo publiſhed, 1. *Hiſtoria animalium Angliæ*. quarto. 2. *Conchyliorum ſynopſis*, folio. 3. *Cochlearum & limachum exercitatio anatomica*, 4 vols 8vo. 4. Many pieces in the Philoſophical Tranſactions; and other works.

LISTOWEL, a pariſh, alſo a poſt and fair town, of Ireland, in the county of Kerry and province of Munſter, 131 miles from Dublin, anciently *Lis Tuathal*, i. e. "the fort of Tuathal," who was exiled in the 1ſt century, but returned; and his life forms a brilliant era in Iriſh hiſtory. Near this are the ruins of a caſtle, pleaſantly ſituated on the river Feale: it was taken in November 1600, by Sir Charles Wilmot, being then held out for the Lord Kerry againſt Queen Elizabeth. Five miles beyond Liſtowel are the ruins of a church. The fairs are three in a year.

LITANA Silva (anc. geog.); a wood of the Boii, in the Gallia Togata, or Ciſpadana, where the Romans, under L. Poſthumius Albinus (whoſe head the Boii cut off, and carried in triumph into their moſt ſacred temple), had a great defeat, of twenty-five thouſand ſcarce ten eſcaping (Livy). Holſtenius conjectures, that this happened above the ſprings of the Scultenna, in a part of the Appenine, between Cerſinianum and Mutina. Now *Selva di Lugo*.

LITANY, a ſolemn form of ſupplication to God, in which the prieſt utters ſome things fit to he prayed for, and the people join in their interceſſion, ſaying, *we beſeech thee to hear us, good Lord*, &c. The word comes from the Greek λιτανεια, "ſupplication;" of λιτανευω, "I beſeech."

At firſt the uſe of litanies was not fixed to any ſtated time, but were only employed as exigencies required. They were obſerved in imitation of the Ninevites, with ardent ſupplications and faſtings, to avert the threatening judgments of fire, earthquakes, inundations, or hoſtile invaſions. About the year 400, litanies began to be uſed in proceſſions, the people walking barefoot, and repeating them with great devotion; and it is pretended, that by this means ſeveral countries were delivered from great calamities. The days on which theſe were uſed were called *rogation days:* theſe were appointed by the canons of different councils, till it was decreed by the council of Toledo, that they ſhould be uſed every month throughout the year; and thus by degrees they came to be uſed weekly on Wedneſdays and Fridays, the ancient ſtationary days for faſting. To theſe days the rubric of the church has added Sundays, as being the greateſt days for aſſembling at divine ſervice. Before the laſt review of the common prayer, the litany was a diſtinct ſervice by itſelf, and uſed ſome time after the morning prayer was over; at preſent it is made one office with the morning-ſervice, being ordered to be read after the third collect for grace, inſtead of the interceſſional prayers in the daily ſervice.

LITCHFIELD, a city of Staffordſhire, in England, 117 miles from London. It ſtands low, about three miles from the Trent; and its ancient name is ſaid to have been *Licidfield*, ſignifying, "a field of carcaſſes," from a great number of Chriſtians having, as it is pretended, ſuffered martyrdom here in the perſecution under Diocleſian. In the Saxons time, it was a biſhopric for a ſhort ſpace; and is now, together with Coventry, a biſhoprick. It is divided into two parts by a rivulet and a kind of ſhallow lake, over which are two cauſeways with ſluices. It is a long ſtraggling place; but has ſome very handſome houſes, and well-paved clean ſtreets. That part on the ſouth ſide of the rivulet is called the *city*, and the other the *cloſe*. The *city* is much the largeſt, and contains ſeveral public ſtructures. It was incorporated by Ed. VI. with the name of bailiffs and burgeſſes; and is both a town and county, governed by two bailiffs choſen yearly out of 24 burgeſſes, a recorder, a ſheriff, a ſteward, and other officers. The city has power of life and death within their juriſdiction, a court of record, and a piepowder court. Here is a gaol both for debtors and felons, a free ſchool, and a pretty large well endowed hoſpital for a maſter and 12 brethren. The county of the city is 10 or 12 miles in compaſs, which the ſheriff rides yearly on the 8th of September, and then feaſts the corporation and neighbouring gentry. The *cloſe* is ſo called from its being incloſed with a wall and a deep dry ditch on all ſides except towards the city, where it is defended by a great lake or marſh formed by its brook. The cathedral, which ſtands in the cloſe, was originally built by Oſwius king of Northumberland about 300. It was rebuilt and enlarged by Offa king of Mercia in 766. In 1148 was rebuilt, and greatly enlarged in 1296. At the reformation, Coventry was divided from it. In the civil wars its ſpire was deſtroyed, and it converted to a ſtable. In 1776 a beautiful painted window, by the benefaction of Dr Adenbrook, has been ſet up at the weſtern end of the cathedral. In the civil wars it was ſeveral times taken and retaken, and thereby ſuffered much; but was ſo repaired after the reſtoration, at the expence of 20,000 l. that it was one of the faireſt and nobleſt ſtructures of the kind in England. It is is walled in like a caſtle, and ſtands ſo high as to be ſeen 10 mlies round. It is 450 feet long, of which the choir is 110, and the breadth in the broadeſt place 80. Its portico is hardly to be paralleled in England. There were till lately 26 ſtatues of the prophets, apoſtles, kings of Judah, and ſome kings of England, in a row above it, as big as the life; and on the top, at each corner of the portico, is a ſtately ſpire, beſides a fine high ſteeple on the middle of the church. The choir is paved in great part with alabaſter and channel-coal, in imitation of black and white marble. In 1789 it went under a general repair, when the maſſive groined arch betwixt the weſt end of the church and the tranſcript, which had forced the ſide wall out of its perpendicular, was removed. The prebendaries ſtalls, which are thought to be the beſt in England, were moſt of them re-erected at the charge of the country gentlemen, whoſe names and arms are painted at the top of the ſtalls. The north door is extremely rich in ſculpture, but much injured by time. The body, which is ſupported by pillars formed of numbers of ſlender columns, has lately had its decayed leaden roof replaced by a neat ſlated covering. The choir merits attention on account of the elegant ſculpture about the windows, and the embattled gallery that runs beneath them; to which the altar-piece of Grecian architecture but ill correſponds; behind which is Mary's chapel, divided from it by a moſt elegant ſtone ſkreen of beautiful workmanſhip. Here ſtood St Chad's ſhrine, which coſt 2000 l. The charter-houſe is an octagon-room. In the ſame cloſe are the palaces of the biſhop and dean, and the prebendaries houſes in a court on the hill. Here are three other churches; one of which, St Michael's, has a church-yard of 6 or 7 acres. There was a caſtle here, long ſince deſtroyed: and ancient camps have been diſcovered in its environs. In the neighbourhood are frequent horſe-races. The markets there are on Tueſday and Friday, and ſix fairs in the year. By the late inland navigation, this place has communication with the rivers Merſey, Dee, Ribble, Ouſe, Trent, Darwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles in the counties of Lincoln, Nottingham, York, Lancaſter, Weſtmoreland, Cheſter, Warwick, Leiceſter, Oxford, Worceſter, &c. Litchfield ſends two members to parliament.

LITERARY, any thing belonging to LITERATURE.

LITERARY Property or *Copy-Right*. See *COPY-Right*.

LITERATI (*letrados*, "lettered"), an epithet given to ſuch perſons among the Chineſe as are able to read and write their language. The literati alone are capable of being made mandarins.

LITERATI is alſo the name of a particular ſect, either in religion, philoſophy, or politics, conſiſting principally of the learned men of that country; among whom it is called *jukaio*, i. e. "learned."

It had its riſe in the year of Chriſt 1400, when the emperor, to awaken the native affection of the people for knowledge, which had been quite baniſhed by the preceding civil wars among them, and to ſtir up emulation among the mandarins, choſe out 42 of the ableſt among their doctors, to whom he gave a commiſſion to compoſe a body of doctrine agreeable to that of the ancients, which was then become the rule or ſtandard of the learned. The delegates applied themſelves to the buſineſs with very great attention; but ſome fancied them rather to have wreſted the doctrine of the ancients, to make it conſiſt with theirs, than to have built up theirs on the model of the ancients.

They ſpeak of the Deity, as if it were no more than mere nature or the natural power or virtue that produces, diſpoſes, and preſerves, the ſeveral parts of the univerſe. It is, ſay they, a pure, perfect principle, without beginning or end; it is the ſource of all things, the eſſence of every being and that which determines it to be what it is. They make God the ſoul of the world: they ſay, he is diffuſed through all matter, and produces all the changes that happen there. In ſhort, it is not eaſy to determine, whether they reſolve God into nature, or lift up nature into God; for they aſcribe to it many of thoſe things which we attribute to God.

This doctrine, in lieu of the idolatry that prevailed before, introduced a refined kind of atheiſm. The work, being compoſed by ſo many perſons of learning and parts, and approved by the emperor himſelf, was received with infinite applauſe by all the people. Many were pleaſed with it, becauſe it ſeemed to ſubvert all religion; others approved it, becauſe the little religion that it left them could not give them much trouble. And thus was formed the ſect of the Literati; which conſiſts of the maintainers and adherents to this doctrine.

The court, the mandarins, and the perſons of fortune and quality, &c. are generally retainers to it; but a great part of the common people ſtill hold to their worſhip of idols.

The literati freely tolerate the Mahometans, becauſe they adore, with them, the king of heaven, and author of nature; but they bear a perfect averſion to all ſorts of idolaters among them; and it was once reſolved to extirpate them. But the diſorder this would have occaſioned in the empire prevented it; they now content themſelves with condemning them, in general, as hereſies; which they do ſolemnly every year at Pekin.

LITERATURE denotes learning or ſkill in letters

LITERNUM. See LINTERNUM.

LITHANTHRAX, or *Pit-Coal*, is a black or brown, laminated, bituminous ſubſtance; not very eaſily inflammable; but when once inflamed, burns longer and more intenſely than any other ſubſtance. Of this ſubſtance three kinds are diſtinguiſhed by authors. The reſiduum of the firſt after combuſtion is black; the reſiduum of the ſecond is ſpungy, and like pumice-ſtone; and the reſiduum of the third is whitiſh aſhes. Some foſſil coal, by long expoſure to air, falls into a greyiſh powder, from which alum may be extracted. Foſſil coal by diſtillation yields, 1. a phlegm or water; 2. a very acid liquor; 3. a thin oil like naphtha; 4. a thicker oil, reſembling petroleum, which falls to the bottom of the former, and which riſes with a violent fire; 5. an acid concrete ſalt; 6. an uninflammable earth remains in the retort. Theſe conſtituent parts of foſſil-coal are very ſimilar to thoſe of amber and other bitumens. For the exciting of intenſe heats, as of furnaces for ſmelting iron-ore, and for operations where the acid and oily vapours would be detrimental, to the drying of malt, foſſil-coals are previouſly charred, or reduced to *coaks*; that is, they are made to undergo an operation ſimilar to that by which charcoal is made. By this operation coals are deprived of their phlegm, their acid liquor, and the greateſt part of their fluid oil. Coaks therefore conſiſt of the two moſt fixed conſtituent parts, the heavy oil and the earth, together with the acid concrete ſalt, which tho' volatile is detained by the oil and earth.

LITHARGE, a preparation of lead, uſually in form of ſoft flakes, of a yellowiſh reddiſh colour. If calcined lead be urged with a haſty fire it melts into the appearance of oil, and on cooling concretes into litharge. Greateſt part of the litharge met with in the ſhops is produced in the purification of ſilver from lead, and the refining of gold and ſilver by means of this metal; according to the degree of fire and other circumſtances, it proves of a pale or deep colour; the firſt has been commonly called *litharge of ſilver*, the other *litharge of gold*. See CHEMISTRY-*Index*.

LITHGOW (William), a Scotſman, whoſe ſufferings by impriſonment and torture at Malaga, and whoſe travels, on foot, over Europe, Aſia, and Africa, ſeem to raiſe him almoſt to the rank of a martyr and a hero, publiſhed an account of his peregrinations and adventures. Though the author deals much in the marvellous, the horrid account of the ſtrange cruelties of which, he tells us, he was the ſubject, have however, an air of truth. Soon after, his arrival in England from Malaga, he was carried to Theobald's on a feather-bed, that King James might be an eye-witneſs of his *martyred anatomy*, by which he means his wretched body, mangled and reduced to a ſkeleton. The whole court crowded to ſee him; and his Majeſty ordered him to be taken care of, and he was twice ſent to Bath at his expence. By the king's command he applied to Gondamor, the Spaniſh ambaſſador, for the recovery of the money and other things of value which the governor of Malaga had taken from him, and for L. 1000 for his ſupport. He was promiſed a full reparation for the damage he had ſuſtained; but the perfidious miniſter never performed his promiſe. When he was upon the point of leaving England, Lithgow upbraided him with the breach of his word in the preſence-chamber, before ſeveral gentlemen of the court. This occaſioned their fighting upon the ſpot; and the ambaſſador, as the traveller oddly expreſſes it, had his fiſtula, (with which diſorder he was afflicted) contrabanded with his fiſt. The unfortunate Lithgow, who was generally condemned for his ſpirited behaviour, was ſent to the Marſhalſea, where he continued a priſoner nine months. At the concluſion of the octavo edition of his *Travels* he informs us, that in his three voyages, "his painful feet have traced over (beſides paſſages of ſeas and rivers) 36000 and odd miles, which draweth near to twice the circumference of the whole earth." Here the marvellous ſeems to riſe to the incredible; and to ſet him, in point of veracity, below Coryat, whom it is nevertheleſs certain that he far outwalked. His deſcription of Ireland is whimſical and curious. This, together with the narrative of his ſufferings, is reprinted in Morgan's *Phœnix Britannicus*.

LITHIASIS, or STONE. See MEDICINE-*Index*.

LITHOMANTIA, in antiquity, a ſpecies of divination performed with ſtones. Sometimes the ſtone called *ſiderites* was uſed: this they waſhed in ſpring-water in the night by candle light; the perſon that conſulted it was to be purified from all manner of pollution, and to have his face covered; this done he repeated divine prayers, and placed certain characters in an appointed order; and then the ſtone moved of itſelf, and in a ſoft gentle murmur, or (as ſome ſay) in a voice like that of a child, returned an anſwer. By a ſtone of this nature, Helena is reported to have foretold the deſtruction of Troy.

LITHONTRIPTICUS (from λιθος "a ſtone," and θρυπτω "to break"); an epithet for medicines that are ſuppoſed to break the ſtone in the bladder. Though the different ſtones that are generated in the human bladder require different ſolvents when out of the body; and though art hath not yet afforded a medicine which, when injected into the bladder, will, without injury thereto, diſſolve the ſtone therein lodged; it cannot thence be concluded, that there are no lithontriptic medicines. It may be here obſerved, that one ſolvent affects one ſubject, but hath no effect on another; ſo a ſolvent may yet be met with that will deſtroy the ſtone, and not hurt the human body. The water into which the boiled white of egg diſſolves will liquefy myrrh, but may be put into the human eye without cauſing any uneaſineſs.

Soap ley taken at firſt in ſmall doſes in broth that is freed from all its fat, ſucceeds in moſt caſes which require an alkaline ſolvent. The patient may begin with 20 drops, and gradually increaſe the doſe as he is able; and by repeating it three times a-day for ſix, eight, or twelve months, the wiſhed for effects often follow.

LITHOPHYTA, the name of Linnæus's third order of vermes. See Zoology.

LITHOSPERMUM, GROMWELL, A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 41ſt order, *Aſperifoliæ*. The corolla is funnel-ſhaped, with the throat perforated and naked; the calyx quinquepartite. There are ſeveral ſpecies; but the only remarkable ones are the officinale or common gromwell, and the arvenſe or baſtard alkanet. Both theſe are natives of Britain; the former growing in dry gravelly ſoil, the latter in corn-fields. The ſeeds of the firſt are reputed to be of ſervice in calculous caſes. Dr Grew ſays, that they have ſo much earth in their compoſition, that they effervеſce with acids; but if this is the caſe, it muſt be attributed rather to an alkaline than an earthy quality,

LITHOSTROTION, in natural hiſtory, the name of a ſpecies of foſſil coral, compoſed of a great number of long and ſlender columns, ſometimes round, ſometimes angular, jointed nicely to one another, and of a ſtarry or radiated ſurface at their tops. Theſe are found in conſiderable quantities in the northern and weſtern parts of Britain, ſometimes in ſingle, ſometimes in complex ſpecimens. See Plate CC.

LITHOSTROTON, among the Romans, was a pavement of Moſaic work, conſiſting of ſmall pieces of cut marble of different kinds and colours. The *lithoſtrota* began to be uſed in the time of Sylla, who made one at Præneſte in the temple of Fortune. At laſt they were uſed in private houſes; and were brought to ſuch perfection, that they exhibited moſt lively repreſentations of nature, with all the exactneſs of the fineſt painting.

LITHOTOMY, in ſurgery, the operation of cutting for the ſtone. See Surgery.

LITHUANIA, an extenſive province of Poland. By the natives it is called *Letwa*, and has Great Poland and Ruſſia on the weſt; part of Muſcovy on the eaſt; Livonia, the Baltic Sea, and part of Muſcovy, on the north; Red Ruſſia, Volhinia, and Podolia on the ſouth; and the Ukraine on the ſouth-eaſt. Its length is ſaid to be about 360, and its breadrh 340 miles; but it is much indented both ways. Lithuania was anciently over-run with wood; and there are ſtill many foreſts in it, which yield a great deal of honey, wax, pitch, tar, and timber; and abound with wild boars, baffaloes, elks, wild horſes, wild aſſes, uri, and woodcocks. The lakes are alſo numerous, and well-ſtored with fiſh, but the air, by reaſon of theſe foreſts and lakes, is ſaid to be thick and foggy. The country produces a great deal of buck-wheat and other corn, the paſtures are luxuriant, and the flocks and herds numerous; ſo that, notwithſtanding agriculture is much neglected, proviſions are exceedingly cheap, but money ſo ſcarce, that 10 *per cent*, is the common intereſt. The principal nobility have large eſtates, and live in great pomp and ſplendor, generally retaining ſome hundreds of thoſe that are poor, in quality of domeſtics. The eſtabliſhed religion is Popery; but Lutherans, Calviniſts, Jews, Turks, Greeks, and Socinians, are very numerous. Lithuania was governed by its own dukes till it was united to Poland, towards the end of the 14th century, when the great Duke Jagello married Hedwig, the dowager of Louis king of Poland and Hungary. It had even dukes after that, but they were ſubordinate to the king; and at this day, tho' one diet ſerves for both countries, yet each has its peculiar laws, cuſtoms, dialect, and privileges. In a diet held at Lublin in 1569, it was more cloſely united to Poland than it had been before; and it was enacted, that both countries, for the future, ſhould form but one ſtate under the ſame prince. As to their courts of juſtice, the tenth part of what is adjudged in all real actions goes always to the judge's box, and is immediately paid in court; and in perſonal actions he claims half the damages given. A nobleman is only fined for murder, as in Poland. The common people here, excepting the burghers in the royal towns, and the Germans, are ſlaves; and, in many places, the ignorant vulgar ſtill retain ſome remains of idolatry. The poor people have only Mondays to themſelves; and if their lords have occaſion for them even on that day, the peaſant muſt work for himſelf on Sunday. If any of them is condemned to death by his lord, he muſt execute himſelf, or ſuffer greater cruelty. The dialect is a language of the Sclavonic; and they ſpeak here, as in Poland, a barbarous kind of Latin. Lithuania is divided into nine palatinates. Another diviſion is into Lithuania properly ſo called, and Lithuanian Ruſſia. Some alſo comprehend under it Samogitia and Courland, which is a fief of Poland.

LITMUS, or Lacmus, in the arts, is a blue pigment, formed from *archil*. It is brought from Holland at a cheap rate; but may be prepared by adding quick lime and putrified urine, or ſpirit of urine diſtilled from lime, to the archil previouſly bruiſed by grinding. The mixture having cooled, and the fluid ſuffered to evaporate, becomes a maſs of the conſiſtence of a paſte, which is laid on boards to dry in ſquare lumps. It is only uſed in miniature paintings, and cannot be well depended on, becauſe the leaſt approach of acid changes it inſtantly from blue to red. The beſt litmus is very apt to change and fly.

LITTER *(lectica)*, a kind of vehicle borne upon ſhafts; anciently eſteemed the moſt eaſy and genteel way of carriage. Du-Cange derives the word from the barbarous Latin *lectaria* "ſtraw or bedding for beaſts." Others will rather have it from *lectus* "bed;" there being ordinarily a quilt and a pillow to a litter in the ſame manner as to a bed.

Pliny calls the litter the *traveller's chamber:* it was much in uſe among the Romans, among whom it was borne by ſlaves kept for that purpoſe; as it ſtill continues to be in the eaſt, where it is called a *palanquin.*—The Roman lectica, made to be borne by four men, was called *tetraphorum*; that borne by ſix *hexaphorum*; and that borne by ſix or eight *octaphorum*

The invention of litters, according to Cicero, was owing to the kings of Bithynia: in the Time of Tiberius they were become very frequent at Rome, as appears from Seneca; and even ſlaves themſelves were borne in them, though never by more than two perſons, whereas men of quality had eight.

Litter alſo denotes a parcel of dry old ſtraw put on the floor of a horſe's ſtall for him to lie down and reſt upon. When a horſe comes tired into a ſtable, freſh litter has the virtue of making him ſtale immediately. This is known to be a very great advantage to a horſe in a tired ſtate; and when the litter is old and dirty, it never has any ſuch effect upon him. If the owners knew how refreſhing it is for a horſe to diſcharge his urine on his return from labour, they would be more careful of giving them all means and occaſions of it than they are. This ſtaling after fatigue prevents thoſe obſtructions in the neck of the bladder or urinary paſſages which horſes are too ſubject to. The bladder being often inflamed by the long retention of the heated urine in it, the creature is thus in danger of periſhing.

LITTLE (William), an ancient Engliſh hiſtorian known alſo by the name of *Gulielmus Neubrigenſis*, was born at Bridlington in the county of York in the year 1136; and educated in the abbey of Newborough in the ſame county, where he became a monk. In his advanced years, he compoſed a hiſtory of England, in five books from the Norman conqueſt to A. D. 1197; which for veracity, regularity of diſpoſition, and purity of language, is one of the moſt valuable productions of this period.

LITTLETON (Sir Thomas), judge of the common-pleas, was the eldeſt ſon of Thomas Weſtcote, eſq; of the county of Devon, by Elizabeth, ſole heireſs of Thomas Littleton of Frankley in Worceſterſhire, at whoſe requeſt he took the name and arms of that family. He was educated at one of the univerſities, probably at Cambridge. Thence he removed to the Inner Temple, where he became one of the readers; and was afterwards, by Henry VI. made ſteward or judge of the court of the palace, or marſhalſea of the king's houſehold. In 1455, the thirty-third of that reign, he was appointed king's ſerjeant, and rode the northern circuit as judge of aſſize. In 1462, the ſecond of Edward IV. he obtained a pardon from the crown; and, in 1466, was appointed one of the judges of the common-pleas, and rode the Northamptonſhire circuit. In the year 1474 he was, with many of the firſt nobility, created knight of the Bath. He died in 1481; and was buried in the cathedral church of Worceſter, where a marble tomb, with his ſtatue upon it, was erected to his memory. As to his character as a lawyer, it is ſufficient to inform the reader, that he was the author of the Treatiſe upon Tenures, on which Sir Edward Coke wrote a comment, well known by the title of *Coke upon Littleton*.

Littleton (Adam), deſcended from an ancient family in Shropſhire, was born in 1627, educated at Weſtminſter-ſchool, and went to Oxford a ſtudent of Chriſt-church, whence he was ejected by the parliament viſitors in 1648. Soon after, he became uſher of Weſtminſter-ſchool, and in 1658 was made ſecond maſter of Weſtminſter-ſchool. After the reſtoration he taught a ſchool at Chelſea in Middleſex, of which church he was admitted rector in the year 1664. In 1670 he accumulated the degrees in divinity, being then chaplain in ordinary to his majeſty. In 1674 he became prebendary of Weſtminſter, of which church he was afterwards ſub-dean. Beſide the well-known *Latin* and *Engliſh* Dictionary, he publiſhed ſeveral other works. He died in 1694, and was interred at Chelſea. He was an univerſal ſcholar; and extremely charitable, humane, and eaſy of acceſs.

LITURGY, denotes all the ceremonies in general belonging to divine ſervice.

The word comes from the Greek λειτουργια "ſervice, public miniſtry;" formed of λειτος "public," and εργον "work."

In a more reſtrained ſignification, liturgy is uſed among the Romaniſts to ſignify the *maſs*; and among Proteſtants the *common-prayer*.

All who have written on liturgies agree, that in the primitive days divine ſervice was exceedingly ſimple, only clogged with a very few ceremonies, and conſiſting of but a ſmall number of prayers; but, by degrees, they increaſed the number of external ceremonies, and added new prayers, to make the office look more awful and venerable to the people. At length things were carried to ſuch a pitch, that a regulation became neceſſary; and it was found proper to put the ſervice, and the manner of performing it, into writing; and this was what they called a *liturgy*.

Liturgies have been different at different times, and in different countries. We have the liturgy of St Chryſoſtom, that of St Peter, of St James, the liturgy of St Baſil, the Armenian liturgy, the liturgy of the Maronites, of the Cophtæ, the Roman liturgy, the Gallican liturgy, the Engliſh liturgy, the Ambroſian liturgy, the Spaniſh and African liturgies, &c.

In the more early ages of the church, every biſhop had a power to form a liturgy for his own dioceſe; and if he kept to the analogy of faith and doctrine, all circumſtances were left to his own diſcretion. Afterwards the practice was for the whole province to follow the metropolitan church, which alſo became the general rule of the church; and this Lindwood acknowledges.

ledges to be the common law of the church; intimating, that the uſe of ſeveral ſervices in the ſame province, which was the caſe in England, was not to be warranted but by long cuſtom. The liturgy of the church of England was compoſed in the year 1547, and eſtabliſhed in the ſecond year of King Edward VI. ſtat. 2. and 3. Edward VI. cap. 1.

In the fifth year of this king it was reviewed; becauſe ſome things were contained in that liturgy which ſhowed a compliance with the ſuperſtition of thoſe times, and ſome exceptions were taken againſt it by ſome learned men at home, and by Calvin abroad. Some alterations were made in it, which conſiſted in adding the general confeſſion and abſolution, and the communion to begin with the ten commandments. The uſe of oil in confirmation and extreme unction were left out, and alſo prayers for ſouls departed, and what tended to a belief of Chriſt's real preſence in the euchariſt. This liturgy, ſo reformed, was eſtabliſhed by the act of 5 and 6 Ed. VI. cap. 1. However, it was aboliſhed by Queen Mary, who enacted, that the ſervice ſhould ſtand as it was moſt commonly uſed in the laſt year of the reign of King Henry VIII. The liturgy of 5 and 6 Ed. VI. was re-eſtabliſhed with ſome few alterations and additions, by 1 Eliz. cap. 2. Some farther alterations were introduced, in conſequence of the review of the common prayer-book, by order of King James, in the firſt year of his reign; particularly in the office of private baptiſm, in ſeveral rubricks and other paſſages, with the addition of five or ſix new prayers and thankſgivings, and all that part of the catechiſm which contains the doctrine of the ſacraments. The book of common prayer, ſo altered, remained in force from the firſt year of King James to the fourteenth of Charles II. But the laſt review of the liturgy was in the year 1661, and the laſt act of uniformity enjoining the obſervance of it is 13 and 14 Car. II. cap. 4. See *Common-Prayer*. Many applications have been ſince made for a review, but hitherto without ſucceſs.

LITUUS, among the Romans, was the ſtaff made uſe of by the augurs in quartering the heavens. It bore a great reſemblance to the croſier of a biſhop, but was ſhorter. It was crooked at one end, and thickeſt in the curved part, according to A. Gellius. We frequently meet with a repreſentation of it upon medals, amongſt other pontifical inſtruments. It was called *Lituus Quirinalis*, from Qurinus, a name of Romulus, who was ſkilled in all the myſteries of augury.

Lituus, was alſo an inſtrument of muſic in uſe in the Roman army. It was ſtraight, excepting that it had a little bending at the upper end like a lituus or ſacred ſtaff of the augurs; and from the ſimilitude it derived its name. The lituus, as an inſtrument of martial muſic, was of a middle kind, betwixt the cornu and tuba.

LIVADIA, anciently *Achaia* and *Hellas*, or *Greece*, properly ſo called; a province of Turkey in Europe, bounded on the north by Epirus and Theſſaly, from which it is ſeparated by mount Oeta, now Banina, and by the Euripus, now the ſtrait of Negropont; on the eaſt by the Archipelago; on the ſouth, by the gulf of Engia or Egina, the iſthmus of Corinth, and the gulf of Lepanto; and on the weſt, by the Ionian ſea and part of Epirus. Its extent is about 130 miles from north-weſt to ſouth eaſt; but its greateſt breadth is not above 36 miles. It is in general a mountainous country; but neither unpleaſant nor unfruitful. The principal mountains are, mount Oeta in Bœotia, where is the famous paſs of Thermopylæ, not above 25 feet broad; and Parnaſſus, Helicon, and Cythæron in Phocis, which were ſacred to Apollo and the muſes, and conſequently much celebrated by the poets. The rivers of moſt note are, the Sionapro, anciently the Achelous, the Cephiſſus, the Iſmenus, and the Aſopus. The province is at preſent divided into Livadia proper, Stramulippa, and the duchy of Athens. The principal places are, Lepanto, anciently Naupactus; Livadia, anciently Libadia or Lebadia; the celebrated city of Athens, now Setines; Thebes, now Stibes; Lepſina, anciently Eleuſis; Caſtri, formerly Delphi; and Megara.

Livadia, an ancient town of Turkey in Europe, and capital of a province of the ſame name in Greece. It is a large and populous place, ſeated on the gulf of Lepanto, about 25 miles from the city of that name. It has now a conſiderable trade in woollen ſtuffs and rice. Anciently it was celebrated for the oracle of Trophonius, which was in a cavern in a hill above the town. E. Long. 23. 29. N. Lat. 38. 40.

LIVER, in anatomy. See there, nº 96.—Plato, and other of the ancients, fix the principle of love in the liver; whence the Latin proverb, *Cogit amare jecur:* and in this ſenſe Horace frequently uſes the word, as when he ſays, *Si torrere jecur quæris Idoneum.*—The Greeks, from its concave figure, called it *ηπαρ*, "vaulted, ſuſpended; the Latins call it *jecur*, q. d. *juxta cor*, as being "near the heart." The French call it *foye*, from *foyer, focus*, "or fire-place;" agreeable to the doctrine of the ancients, who believed the blood to be boiled and prepared in it.—Eraſiſtratus, at firſt, called it *parenchyma*, i. e. *effuſion*, or *maſs of blood*; and Hippocrates, by way of eminence frequently calls it the *hypochondrium*.

Liver of Antimony See Chemistry-*Index*.

Liver of Arſenic, is a combination of white arſenic with liquid fixed vegetable alkali, or by the humid way. Arſenic has in general a ſtrong diſpoſition to unite with alkalis. Mr Macquer, in his *Memoirs upon Arſenic*, mentions a ſingular kind of neutral ſalt, which reſults from the union of arſenic with the alkaline baſis of nitre, when nitre is decompoſed, and its acid is diſengaged in cloſe veſſels, by means of arſenic. To this ſalt he has given the name of *neutral arſenical ſalt* †. The liver of arſenic mentioned alſo by that chemiſt, although compoſed, like the neutral arſenical ſalt, of arſenic and fixed alkali, is nevertheleſs very different from that ſalt.

† See *Chemiſtry-Index*

The operation for making liver of arſenic is eaſy and ſimple. To ſtrong and concentrated liquid fixed alkali, previouſly heated, fine powder of white arſenic muſt be added. This arſenic eaſily diſappears and diſſolves, and as much of it is to be added till the alkali is ſaturated, or has loſt its alkaline properties, although it is ſtill capable of diſſolving more arſenic ſuperabundantly. While the alkali diſſolves the arſenic in this operation, it it acquires a browniſh colour, and a ſingular and diſagreeable ſmell; which, however, is not the ſmell of pure arſenic heated and volatilized. Laſtly, this mixture becomes more and more thick, and at length of a gluey conſiſtence. This matter is not cryſtallizable as the neutral arſenical ſalt is. It is eaſily decompoſed by the action of fire, which ſeparates the arſenic. This does not happen to the arſenical ſalt. Any pure acid is capable of ſeparating arſenic from the liver of arſenic, in the ſame manner as they ſeparate ſulphur from liver of ſulphur: whereas the neutral arſenical ſalt cannot be decompoſed but by means of the united affinities of acids and metallic ſubſtances. Thus we ſee that arſenic may be combined with fixed alkali in two very different manners.

The author has given to this combination the name of *liver of arſenic*, to diſtinguiſh it from the neutral arſenical ſalt, and in imitation of the name of the *liver of ſulphur*, given to the combination of the fixed alkali with ſulphur.

Liver of Sulphur. See Chemistry, *Index*.

Liver-Wort, in botany. See Marchantia and Lichen.

Liver-Stone, (lapis hepaticus); a genus of inflammable ſubſtances, containing, beſides its phlogiſton, argillaceous, ponderous, and ſiliceous earth, united with vitriolic acid. See Earths, §. 1. no 4.

Mr Bergman, in his Sciagraphia, informs us, that 100 parts of this ſtone contain 33 of ſiliceous earth, 29 of cauſtic ponderous earth, almoſt 5 of argillaceous earth, and 3.7 of lime, beſides the vitriolic acid and water of cryſtalliſation: but Mr Kirwan quotes another analyſis of the ſame author, where it is ſaid that 100 parts of it contain 33 of baro-ſelenite, 38 of ſiliceous earth, 22 of alum, 7 of gypſum, and 5 of mineral oil.

LIVERPOOL, a large, flouriſhing, and populous town of England, in the county of Lancaſter, ſituated at the influx of the river Merſey into the ſea. This town has ſo much increaſed in trade ſince the commencement of the preſent century, that it is now the greateſt ſea-port in England except London, having exceeded Briſtol conſiderably of late years: which will appear by the following account of the cuſtom-duties, received in the ſeveral ports of London, Liverpool, and Briſtol, in the year 1784, taken from the report of the commiſſioners for inſpecting the ſtate of public accounts.

London, - -	L. 5,187,052	9	5¼
Liverpool, - -	640,684	2	2'
Briſtol, - - -	334,909	19	3¼
Liverpool exceeded Briſtol,	L. 305,774	2	11

The following ſhows how much the trade has increaſed ſince the above period:

Duties received in the port of Liverpool from July 5th 1787, to October 10th 1787. L. 298,361 9 10¼

The merchants here trade to all parts of the world except Turkey and the Eaſt Indies; but the moſt beneficial trade is to Guinea and the Weſt-Indies, by which many of them have acquired very large fortunes.

Liverpool, during the laſt war, carried on more foreign trade than any town in England; and ſuch is the ſtate of it at this time, that there are near three thouſand veſſels cleared from that port in one year to different parts of the world. Here are ſeveral manufactories for China-ware, and pot-houſes which make very fine ware, ſome ſalt-works, glaſs-houſes, and upwards of 50 breweries, from ſome of which large quantities of malt-liquor are ſent abroad. Many of the buildings are formed in the moſt elegant manner; but the old ſtreets are narrow; which defect will ſoon be removed, as the corporation have lately obtained an act of parliament for the improvement of the town, which they have already begun to put in force with great ſpirit, having taken down the principal ſtreets in the centre of the town, and rebuilt them in a ſpacious and moſt magnificent manner; ſo that in a few years it will be one of the handſomeſt towns in England. This town contains ten churches, namely, St Peter's, St Nicholas's, St George's, St Thomas's, St Paul's, St Ann's, St John's, St James's, St Catherine's, and St Mary's. There are alſo meetings for independents, anabaptiſts, quakers, methodiſts, and preſbyterians. The exchange is a noble ſtructure, built of white ſtone in the form of a ſquare, and round it are piazzas where the merchants aſſemble to tranſact buſineſs. Above it are the mayor's offices, the ſeſſions-hall, the council-chamber, and two elegant ball-rooms. The expence of erecting this building amounted to L. 30,000. The cuſtom-houſe is ſituated at the head of the old dock, and is a handſome and convenient ſtructure. Here are many charitable foundations, among which is an excellent grammar-ſchool well endowed, and many of the youth taught in it have exhibitions in the univerſities. The infirmary is a large edifice of brick and ſtone, ſituated on a hill in a very pleaſant airy ſituation, at one end of the town.

In the town is a charity-ſchool ſupported by voluntary ſubſcriptions and contributions for 50 boys and 12 girls, who are not only cloathed and educated, but alſo provided with food and lodging: likewiſe ſeveral alms-houſes for the widows of ſeamen; and an excellent poor-houſe, ſuperior to any in the kingdom, where upwards of 800 men, women, and children, are ſupported, many of whom are employed in ſpinning cotton and wool. There are five large wet docks, three dry docks, and ſeveral graving docks for the repairing of ſhipping; which renders it the moſt commodious ſea-port in the world. The quays which bound theſe docks are covered with warehouſes; which is a convenience that enables the merchant to diſcharge his ſhip at a very ſmall expence. The new priſon lately finiſhed is a noble edifice, being built entirely on the plan of the great and benevolent Mr Howard, for ſolitary confinement; and is perhaps the moſt convenient, airy, magnificent building of the kind in Europe; being upon a very extenſive ſcale.

Liverpool received its charter from king John: it is under the government of a recorder, mayor, and an unlimited number of aldermen, two bailiffs, and a common-council of forty of the principal inhabitants, with a town-clerk and other proper officers. The town has a weekly market on Saturday, and is diſtant from London 204 miles. The progreſſive riſe of population

tion in Liverpool, may be conceived by peruſing the following table :

Year.	Chriſtened.	Buried.	Married.
1660	3	—	—
1680	106	51	5
1700	132	124	35
1720	410	293	58
1740	485	608	137
1760	986	599	408
1780	1709	1544	606
1787	2267	1773	804

By the late inland navigation, Liverpool has communication with the rivers Dee, Ribble, Ouſe, Trent, Derwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings, extends above 500 miles, in the counties of Lincoln, Nottingham, York, Weſtmoreland, Cheſter, Stafford, Warwick, Leiceſter, Oxford, Worceſter, &c. The Merſey, upon which the town is ſituated, abounds with ſalmon, cod, flounders, turbot, plaiſe, and ſmelts ; and at full ſea it is above two miles over. In the neighbourhood are frequent horſe-races on a five-mile courſe, the fineſt for the length in England. The ſoil in and near the town is dry and ſandy, and particularly favourable to the growth of potatoes, on which the farmers often depend more than on wheat or any other grain. Freſh water is brought into the town by pipes, from ſome ſprings four miles off, purſuant to an act of parliament in the reign of Queen Anne. Liverpool ſends two members to parliament.

LIVERY, in matters of dreſs and equipage, a certain colour and form of dreſs, by which noblemen and gentlemen chooſe to diſtinguiſh their ſervants.

Liveries are uſually taken from fancy, or continued in families by ſucceſſion. The ancient cavaliers, at their tournaments, diſtinguiſhed themſelves by wearing the liveries of their miſtreſſes : thus people of quality make their domeſtics wear their livery.

Father Meneſtrier, in his treatiſe of Carouſals, has given a very ample account of the mixtures of colours in liveries. Dion tells us, that Oenomaus was the firſt who invented green and blue colours, for the troops which, in the circus, were to repreſent land and ſea fights.

The Romiſh church has alſo her ſeveral colours and liveries ; white, for confeſſors and virgins, and in time of rejoicing ; black, for the dead ; red, for the apoſtles and martyrs ; blue or violet, for penitents ; and green, in times of hope.

Formerly, great men gave liveries to ſeveral, who were not of their family or ſervants, to engage them in their quarrels for that year ; but this was prohibited by the ſtatutes 1 Rich. II. 1. Hen. IV. cap. 27. 2. and 7 Hen. IV. 8 Hen. VI. cap. 4. 8 Ed. IV. cap. 2 ; and no man, of whatever condition, was allowed to give any livery, but to his domeſtic officers, and council learned in the law. However, moſt of the above ſtatutes are repealed by 3 Car. I. cap. 4.

Livery of Seiſin, in law, ſignifies delivering the poſſeſſion of lands, &c. to him who has a right to them.

LIVERYMEN of London, are a number of men choſen from among the freemen of each company. Out of this body the common-council, ſheriff, and other ſuperior officers for the government of the city, are elected ; and they alone have the privilege of giving their votes for members of parliament, from which the reſt of the citizens are excluded.

LIVIUS (Titus), the beſt of the Roman hiſtorians, as he is called by Mr Bayle, was born at Patavium, or Padua. Few particulars of his life have been handed down to us. Coming to Rome, he acquired the notice and favour of Auguſtus, and there he long reſided. Some have ſuppoſed, (for there is not any proof of it), that he was known to Auguſtus before, by certain Philoſophical Dialogues which he had dedicated to him. Seneca ſays nothing of the dedication : but mentions the dialogues, which he calls hiſtorical and philoſophical ; and alſo ſome books, written purpoſely on the ſubject of philoſophy. Be this as it will, it is probable that he began his hiſtory as ſoon as he was ſettled at Rome ; and he ſeems to have devoted himſelf ſo entirely to the great work he had undertaken, as to be perfectly regardleſs of his own advancement. The tumults and diſtractions of Rome frequently obliged him to retire to Naples ; not only that he might be leſs interrupted in the purſuit of his deſtined taſk, but alſo enjoy that retirement and tranquillity which he could not have at Rome, and which yet he ſeems to have much ſought after : for he was greatly diſſatisfied with the manners of his age, and tells us, that "he ſhould reap this reward of his labour, in compoſing the Roman hiſtory, that it would take his attention from the preſent numerous evils, at leaſt while he was employed upon the firſt and earlieſt ages. He uſed to read parts of his hiſtory, while he was compoſing it, to Mecænas and Auguſtus ; and the latter conceived ſo high an opinion of him, that he pitched upon him to ſuperintend the education of his grandſon Claudius, who was afterwards emperor. After the death of Auguſtus, Livy returned to the place of his birth, where he was received with all imaginable honour and reſpect ; and there he died, in the fourth year of the reign of Tiberius, aged above ſeventy. Some ſay, he died on the ſame day with Ovid : it is certain that he died the ſame year.

Scarce any man was ever more honoured, alive as well as dead, than this hiſtorian. Pliny the younger relates, that a native gentleman travelled from Gades, in the extremeſt parts of Spain, to ſee Livy : and, though Rome abounded with more ſtupendous and curious ſpectacles than any city in the world, yet he immediately returned ; as if, after having ſeen Livy, nothing farther could be worthy of his notice. A monument was erected to this hiſtorian in the temple of Juno, where was afterwards founded the monaſtery of St Juſtina. There, in 1413, was diſcovered the following epitaph upon Livy : *Oſſa Titi Livii Patavini, omnium mortalium judicio digni, cujus prope invicto calamo invicti populi Romani res geſtæ conſcriberentur* ; that is, "The bones of Titus Livius of Patavium, a man worthy to be approved by all mankind, by whoſe almoſt invincible pen the acts and exploits of the invincible Romans were written." Theſe bones are ſaid to be preſerved with high reverence to this day, and are ſhown by the Paduans as the moſt precious remains. In 1451, Alphonſus, king of Arragon, ſent his ambaſſador, Anthony Panormita, to deſire of the citizens of Padua the bone of that arm with which this their famous countryman had written his hiſtory: and, obtaining it, cauſed it to be conveyed to Naples with the greateſt ceremony as a moſt invaluable relic. He is ſaid to have recovered from an ill ſtate of health by the pleaſure he found in reading this hiſtory: and therefore, out of gratitude, put upon doing extraordinary honours to the memory of the writer. Panormita alſo, who was a native of Palermo in Sicily, and one of the ableſt men of the 15th century, ſold an eſtate to purchaſe this hiſtorian.

The hiſtory of Livy, like other great works of antiquity, is tranſmitted down to us exceedingly mutilated and imperfect. Its books were originally an hundred and forty-two, of which are extant only thirty-five. The epitomes of it, from which we learn their number, all remain, except thoſe of the 136th and 137th books. Livy's books have been divided into decades, which ſome will have to have been done by Livy himſelf, becauſe there is a preface to every decade; while others ſuppoſe it to be a modern contrivance, ſince nothing about it can be gathered from the ancients. The firſt decade, beginning with the foundation of Rome, is extant, and treats of the affairs of 460 years. The ſecond decade is loſt; the years of which are ſeventy-five. The third decade is extant and contains the ſecond Punic war, including eighteen years. It is reckoned the moſt excellent part of the hiſtory, as giving an account of a very long and ſharp war, in which the Romans gained ſo many advantages, that no arms could afterwards withſtand them. The fourth decade contains the Macedonian war againſt Philip, and the Aſiatic war againſt Antiochus which takes up the ſpace of about 23 years. The five firſt books of the fifth decade were found at Worms, by Simeon Grynæus, in 1431, but are very defective; and the remainder of Livy's hiſtory, which reaches to the death of Druſus in Germany in 746, together with the ſecond decade, are ſupplied by Freinſhemius.

Never man perhaps was furniſhed with greater advantages for writing a hiſtory than Livy. Beſides his own great genius, which was in every reſpect admirably formed for the purpoſe, he was trained as it were in a city, at that time the empreſs of the world, and in the politeſt reign that ever was; having ſcarcely had any other ſchool than the court of Auguſtus. He had acceſs to the very beſt materials, ſuch as the Memoirs of Sylla, Cæſar, Labienus, Pollio, Auguſtus, and others, written by themſelves. "What writers of memorials (ſays Lord Bolinbroke), what compilers of the Materia Hiſtorica, were theſe! What genius was neceſſary to finiſh up the pictures that ſuch maſters had ſketched! Rome afforded men that were equal to the taſk. Let the remains, the precious remains, of Salluſt, of Livy, and of Tacitus, witneſs this truth.——What a ſchool of public and private virtue had been opened to us at the reſurrection of learning, if the latter hiſtorians of the Roman commonwealth, and the firſt of the ſucceeding monarchy, had come down to us entire! The few that are come down, though broken and imperfect, compoſe the beſt body of hiſtory that we have; nay, the only body of ancient hiſtory that deſerves to be an object of ſtudy. It fails us indeed moſt at that remarkable and fatal period, where our reaſonable curioſity is raiſed the higheſt. Livy employed forty-five books to bring his hiſtory down to the end of the ſixth century, and the breaking out of the third Punic war; but he employed ninety-five to bring it down from thence to the death of Druſus; that is, through the courſe of 120 or 130 years. Appian, Dion Caſſius, and others, nay, even Plutarch included, make us but poor amends for what is loſt of Livy." Speaking then of Tully's orations and letters, as the beſt adventitious helps to ſupply this loſs, he ſays, that "the age in which Livy flouriſhed, abounded with ſuch materials as theſe: they were freſh, they were authentic: it was eaſy to procure them; it was ſafe to employ them. How he did employ them in executing the ſecond part of his deſign, we may judge from his execution of the firſt; and, I own, I ſhould be glad to exchange, if it were poſſible, what we have of this hiſtory for what we have not. Would you not be glad, my lord, to ſee, in one ſtupenduous draught, the whole progreſs of that government from liberty to ſervitude; the whole ſeries of cauſes and effects, apparent and real, public and private?" &c.

The encomiums beſtowed upon Livy, by both ancients and moderns, are great and numerous. He not only entertains like Herodotus; he alſo inſtructs and intereſts in the deepeſt manner. But the great probity, candour, and impartiality, are what have diſtinguiſhed Livy above all hiſtorians; for neither complaiſance to the times, nor his particular connections with the emperor, could reſtrain him from ſpeaking well of Pompey; ſo well, as to make Auguſtus call him a *Pompeian*. This we learn from Cremutius Cordus, in Tacitus; who relates alſo, much to the emperor's honour, that this gave no interruption to their friendſhip. But whatever elogies Livy may have received as an hiſtorian, he has not eſcaped cenſure as a writer. In the age wherein he lived, Aſinius Pollio charged him with Patavinity; which Patavinity has been variouſly explained by various writers, but is generally ſuppoſed to relate to his ſtyle. The moſt common is, that this noble Roman, accuſtomed to the delicacy of the language ſpoken in the court of Auguſtus, could not bear with certain provincial idioms, which Livy, as a Paduan, uſed in divers places of his hiſtory. Pignorius is of another mind, and believes that this Patavinity regarded the orthography of certain words, wherein Livy uſed one letter for another, according to the cuſtom of his country, writing *ſibe* and *quaſe* for *ſibi* and *quaſi*; which he attempts to prove by ſeveral ancient inſcriptions. The expreſſions, however, or the orthography of words, are not loaded with obſcurity, and the perfect claſſic is as familiarly acquainted with thoſe ſuppoſed provincialiſms as with the pureſt Latinity.—Livy has been cenſured too, and perhaps with juſtice, for being too credulous, and burdening his hiſtory with vulgar notions and ſuperſtitious tales. He may diſguſt when he mentions that milk and blood were rained from heaven, or that an ox ſpoke or a woman changed her ſex; yet he candidly confeſſes that he recorded only what made an indelible impreſſion upon the minds of a credulous age.

Is it worth while to mention here the capricious and tyrannic humour of the Emperor Caligula, who accuſed Livy of being a negligent and wordy writer, and reſolved therefore to remove his works and ſtatues out of all libraries, where he knew they were curiouſly preſerved? Or the ſame humour in Domitian, another prodigy of nature, who put to death Metius Pompoſianus, becauſe he made a collection of ſome orations of kings and generals out of Livy's hiſtory? Pope Gregory the Great, alſo, would not ſuffer Livy in any Chriſtian library, becauſe of the Pagan ſuperſtition wherewith he abounded: but the ſame reaſon held good againſt all ancient authors; and indeed Gregory's zeal was far from being levelled at Livy in particular, the pontiff having declared war againſt all human learning.

Though we know nothing of Livy's family, yet we learn from Quintilian, that he had a ſon, to whom he addreſſed ſome excellent precepts in rhetoric. An ancient inſcription ſpeaks alſo of one of his daughters, named *Livia Quarta*: the ſame, perhaps, that eſpouſed the orator Lucius Magius, whom Seneca mentions; and obſerves, that the applauſes he uſually received from the public in his harangues, were not ſo much on his own account, as for the ſake of his father in law.

Our author's hiſtory has been often publiſhed with and without the ſupplement of Frienſhemius. The beſt editions are, that of Gronovius, *cum notis variorum & ſuis*, Lugd. Bat. 1679, 3 vol. 8vo; that of Le Clerc, at Amſterdam, 1709, 10 vol. 12mo; and that of Crevier, at Paris, 1735, 6 vol. 4to. Theſe have the ſupplements.—Learning perhaps never ſuſtained a greater loſs, in any ſingle author, than by the deſtruction of the latter and more intereſting part of Livy. Several eminent moderns have indulged the pleaſing expectation that the entire work of this noble hiſtorian might yet be recovered. It has been ſaid to exiſt in an Arabic verſion: and even a complete copy of the original is ſuppoſed to have been extant as late as the year 1631, and to have periſhed at that time in the plunder of Magdeburg. The munificent patron of learning, Leo X. exerted the moſt generous zeal to reſcue from oblivion the valuable treaſure, which one of his moſt bigoted predeceſſors, above mentioned, had expelled from every Chriſtian library. Boyle has preſerved, under the article Leo, two curious original letters, of that pontiff, concerning his hopes of recovering Livy; which afford moſt honourable proofs of his liberality in the cauſe of letters.—A lately diſcovered fragment of Livy's hiſtory was publiſhed in 1773 by Dr Bruns.

LIVIUS (Andronicus), a comic poet who flouriſhed at Rome about 240 years before the Chriſtian era. He was the firſt who turned the perſonal ſatyrs and feſcennine verſes, ſo long the admiration of the Romans, into the form of a proper dialogue and regular play. Though the character of a player, ſo valued and applauded in Greece, was reckoned vile and deſpicable among the Romans, Andronicus acted a part in his dramatical compoſitions, and engaged the attention of his audience, by repeating what he had laboured after the manner of the Greeks. Andronicus was the freedman of M. Livius Salinator, whoſe children he educated. His poetry was grown obſolete in the age of Cicero, whoſe nicety and judgment would not even recommend the reading of it.

LIVONIA, a large province of the Ruſſian empire, with the title of a duchy. It is bounded on the north by the gulph of Finland, on the weſt by that of Riga, on the ſouth by Courland, and on the eaſt, partly by Pleſcow, and partly by Novogorod. It is about 250 miles from North to ſouth, and 150 from eaſt to weſt. The land is ſo fertile in corn, that it is called the *granary of the north*; and would produce a great deal more, if it was not ſo full of lakes, The fiſh that abound here are ſalmons, carps, pikes, flat fiſh, and many others. In the foreſts there are wolves, bears, elks, rein-deer, ſtags and hares. The domeſtic animals are very numerous; but the ſheep bear very bad wool. Here are a great number of foreſts, which conſiſt of birch-trees, pines, and oaks; and all the houſes of the inhabitants are built with wood. The merchandizes which they ſend abroad are flax, hemp, honey, wax, leather ſkins, and potaſhes. The Swedes were formerly poſſeſſed of this province, but were obliged to abandon it to the Ruſſians after the battle of Pultowa; and it was ceded to them by the peace of the North, concluded in 1722, which was confirmed by another treaty in 1742. It is divided into two provinces, viz. Letonia and Eſtonia; and two iſlands called *Oeſel* and *Dagho*, which are again ſubdivided into ſeveral diſtricts.

LIVONICA-TERRA, a kind of fine bole uſed in the ſhops of Germany and Italy. It is found in Livonia, from whence it takes its name, and alſo in ſome other parts of the world. It is generally brought to us in little cakes, ſealed with the impreſſion of a church and eſutcheon, with two croſs keys.

LIVRE, a French money of account, containing 20 ſols. See *Money-Table*.

LIXA, or LIXUS (anc. geog.) a town on the Atlantic near the river Lixus; made a Roman colony by Claudius Cæſar; ſamous in mythology for the palace of Anteus and his encounter with Hercules, (Pliny). Now *Larache*, ſixty-five leagues to the ſouth of the ſtraits of Gibraltar.

LIXIVIOUS, an appellation given to ſalts obtained from burnt vegetables by pouring water on their aſhes.

LIXIVIUM; in pharmacy, &c. a ley obtained by pouring ſome liquor upon the aſhes of plants; which is more or leſs powerful, as it has imbibed the fixed ſalts contained in the aſhes.

LIXNAW, a barony in the county of Kerry and province of Munſter in Ireland, which gives title of Baron to the earls of Kerry; the village here of this name being their ancient ſeat, where the caſtle was erected. This ſeat ſtands agreeably on the river Brick, which is here cut into ſeveral pleaſant canals, that adorn its plantations and gardens; the improvements are extenſive, moſt of the viſtoes and avenues terminating by different buildings, ſeats, and farm-houſes. The tide flows up to the gardens, whereby boats of a conſiderable burden may bring up goods to the bridge near the houſe: here are two ſtone-bridges over the Brick, the oldeſt of which was built by Nicholas the third baron Lixnaw, who was the firſt perſon that made cauſeways to this place, the land being naturally wet

wet and marſhy. W. Long. 9. 15. N. Lat. 52. 15.

LIZARD, in zoology. See Lacerta.

Lizard, in geography, a cape or promontory of Cornwall, ſituated, according to the moſt common computation, in W. Long. 5. 47. N. Lat. 49. 50.

LLANDAFF. See Landaff.

LLOYD (Nicholas), a learned Engliſh writer in the 17th century, was born in Flintſhire in England, and educated at Wadham college, in Oxford. He was rector of Newington St Mary near Lambeth in Surry, till his death, which happened in 1680. His *Dictionarium Hiſtoricum* is a valuable work, to which Hoffman and Moreri, are greatly indebted.

Lloyd (William), a moſt learned Engliſh writer and biſhop, was born in Berkſhire in England in 1627. He was educated under his father, rector of Sonning, and vicar of Tyle-hurſt in Berkſhire; then went to Oxford, and took orders. In 1660 he was made prebendary of Rippon; and in 1666 chaplain to the king. In 1667 he took the degree of doctor of divinity; in 1672 he was inſtalled dean of Bangor; and in 1680 was conſecrated biſhop of St Aſaph. He was one of the ſix biſhops who, with archbiſhop Sancroft, were committed priſoners to the Tower of London, for ſubſcribing a petition to the king againſt diſtributing and publiſhing his declaration for liberty of conſcience. Soon after the revolution he was made almoner to king William and queen Mary: in 1692 he was tranſlated to the biſhopric of Litchfield and Coventry; and in 1699, to the ſee of Worceſter, where he ſat till his death, which happened in 1717, the 91ſt year of his age. Dr Burnet gives him an exalted character, and his works are highly eſteemed.

LOACH, in ichthyology. See Cobitis.

LOAD, or Lode, in mining, a word uſed eſpecially in tin-mines, for any regular vein or courſe, whether metallic or not; but moſt commonly load means a metallic vein.

It is to be obſerved, that mines in general are veins or cavities within the earth, whoſe ſides receding from or approaching to each other, make them of unequal breadths in different places, ſometimes forming large ſpaces, which are called *holes*; thoſe holes are filled like the reſt with ſubſtances, which, whether metallic, or of any other nature, are called *loads*. When the ſubſtances forming theſe loads are reducible to metal, the loads are by the Engliſh miners ſaid to be alive, otherwiſe they are termed dead loads.

In Cornwall and Devonſhire the loads all hold their courſe from eaſtward to weſtward, tho' in other parts of England they frequently run from north to ſouth. The miners report, that the ſides of the load never bear in a perpendicular, but always overhang either to the north or ſouth above. The mines ſeem to have been ſo many channels through which the waters paſs within the earth; and like rivers they have their ſmall branches opening into them in all directions; theſe are by the miners termed the feeders of the load. Moſt mines have ſtreams of water running through them; and when they are found dry, it ſeems owing to the water having changed its courſe, which it ſeems ſometimes to have been compelled to by the load's having filled up the courſe, and ſometimes to have fallen into other more eaſy channels.

The load is frequently intercepted by the croſſing a vein of earth or ſtone, or ſome other metallic ſubſtance; in which caſe it generally happens, that one part of the load is moved to a conſiderable diſtance on one ſide. The tranſient load is, by the miners, termed a *flooking*; and the part of the load which is moved, is by them ſaid to be *heaved*. This fracture or heave of a load, according to Mr Price, is produced by a ſubſidence of the ſtrata from their primary poſitions, which he ſuppoſes to have been horizontal or parallel to the ſurface of the earth, and therefore ſhould more properly be called a depreſſion than a heave. This heaving of the load would be an inexpreſſible loſs to the miner, did not experience teach him, that as the loads always run on the ſides of the hills, ſo the part heaved is always moved toward the deſcent of the hill; ſo that the miner, working towards the aſcent of the hill, and meeting a flooking, conſiders himſelf as working in the heaved part; wherefore, cutting through the flooking, he works upon its back up the aſcent of the hill, till he recovers the load, and *vice verſa*.

Load is alſo uſed for nine diſhes of ore, each diſh being about half a hundred weight.

LOADSTONE. See Magnet.

LOAMS, in natural hiſtory, are defined to be earths compoſed of diſſimilar particles, ſtiff, denſe, hard, and rough to the touch; not eaſily broke while moiſt, readily diffuſible in water, and compoſed of ſand and a tough viſcid clay. Of theſe loams ſome are whitiſh and others brown and yellow.

LOAN, any thing given to another, on condition of return or payment.

Public Loans. See Funds, and *National Debt*.

LOANDA, a province of the kingdom of Angola in Africa. It is an iſland about 15 miles in length, and three in breadth: remarkable chiefly for the capital of Angola ſituated upon it, in E. long. 12. 25. S. lat. 8. 45. This town was built by the Portugueſe in 1578, under the direction of the firſt Portugueſe governor in theſe parts. It is large, populous, and pleaſantly ſeated on the declivity of a hill near the ſea-coaſt, and facing the ſouth weſt. The iſland is ſupplied with freſh water from wells dug in it; and which are not ſunk below the depth of three feet when they are filled with excellent water. It is remarkable, however, that the water of theſe wells continues good only during the time of high-tide; for, as that ſinks, the water becomes more and more brackiſh, till at laſt it is quite ſalt, almoſt as much as the ſea itſelf. On the coaſt of this iſland are fiſhed the zimbis, or ſhells uſed in ſeveral parts of Africa inſtead of money; and with theſe ſhells, inſtead of coin, is carried on a great part of the traffic of this country.

LOANGO, a kingdom of Africa, extending itſelf about 180 geographical miles in length from ſouth to north; that is, from cape St Catherine under the ſecond degree of ſouth latitude, to a ſmall river called *Lovanda Louiſia*, on the 5th degree of the ſame. From weſt to eaſt it extends from Cape Negro on the coaſt of Ethiopia towards the *Buchumalean* mountains, ſo called on account of their vaſt quantity of ivory and great droves of elephants, about 300 miles. It is divided into four principal provinces, viz. thoſe of Lovangiri, Loango-mongo, Chilongo, and Piri.

The inhabitants are very black, well-ſhaped, and of a mild temper. The men wear long petticoats, from the waiſt downwards, and have round their waiſt a piece of cloth half an ell or a quarter broad, over which they wear the ſkin of a leopard, or ſome other wild beaſt, hanging before them like an apron. On the head they wear a cap made of graſs, and quilted, with a feather a-top of it; and on their ſhoulder, or in their hand, they carry a buffalo's tail, to drive away the muſkettos. The women's petticoats are made only of ſtraw, about an ell ſquare, with which they cover their privities, but leave the greateſt part of their thighs and buttocks bare: the reſt of their body is quite bare, except that on their legs they wear little ſtrings of beads made of ſhells, and ſmall bracelets of ivory on their arms. They anoint themſelves with palm-oil, mixed with a kind of red wood reduced to powder.

This country abounds with poultry, oxen, cows, ſheep, goats, elephants, tigers, leopards, civet-cats, and other animals; ſo that here are great quantities of elephants teeth, and fine furs, to be traded for.

The capital city where the king reſides, is called *Loango*, or *Banza-Loangeri*, and, in the language of the negroes, *Boarie*. This city is ſituated in South lat. 4½ degrees, a league and a half from the ſea-coaſt. It is a pretty large city, ſhaded and adorned with bananas, palm, and other trees. The king, who reſides in a large palace in the middle of it, has about 1500 concubines. If any of them is ſurpriſed in adultery, ſhe and her paramour are inſtantly conveyed to the top of a very high hill, whence they are hurled down headlong from the ſteepeſt place.

Every man marries as many wives here as he pleaſes, who are obliged to get their huſbands a livelihood, as is the practice all along the African coaſt inhabited by blacks. The women, therefore, cultivate the land, ſow and reap, while their lazy huſbands loiter away their time in idleneſs.

The king's revenue conſiſts in elephants teeth, copper, a kind of petticoats made of palm-tree leaves, and called *lavogus:* he has whole ſtore-houſes full of theſe lavogus; but his greateſt riches conſiſt in ſlaves of both ſexes.

LOBBY, in architecture, is a ſmall hall or waiting-room: it is alſo an entrance into a principal apartment, where there is a conſiderable ſpace between that and a portico or veſtibule, and the length or dimenſions will not allow it to be conſidered as a veſtibule or an antiroom. See ANTICHAMBER.

LOBE, in anatomy, any fleſhy protuberant part, as the lobes of the lungs, the lobes of the ears, &c.

LOBELIA, CARDINAL-FLOWER: a genus of the monogamia order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 29th order, *Campanaceæ*. The calyx is quinquefid; the corolla monopetalous, and irregular; the capſule inferior, bilocular, or trilocular. There is a great number of ſpecies, but only four of them are cultivated in Britiſh gardens; two of which are hardy herbaceous plants for the open ground, and two ſhrubby plants for the ſtove. They are all fibrous rooted perennials, riſing with erect ſtalks from two to five or ſix feet high, ornamented with oblong, oval, ſpear-ſhaped, ſimple leaves; and ſpikes of beautiful monopetalous, ſomewhat ringent, five-parted flowers, of ſcarlet, blue, and violet colours. They are eaſily propagated by ſeeds, offſets, and cuttings of their ſtalks. The tender kinds require the common treatment of other exotics. They are natives of America; from which their ſeeds muſt be procured.

The root of a ſpecies called the *ſiphilitica* is an article of the materia medica. This ſpecies grows in moiſt places in Virginia, and bears the winters. It is perennial, has an erect ſtalk three or four feet high, blue flowers, a milky juice, and a rank ſmell. The root conſiſts of white fibres about two inches long, reſembles tobacco in taſte, which remains on the tongue, and is apt to excite vomiting. It is uſed by the North-American Indians as a ſpecific in the venereal diſeaſe. The form is that of decoction; the doſe of which is ordered to be gradually increaſed till it bring on very conſiderable purging, then to be intermitted for a little, and again uſed in a more moderate degree till the cure be completed. The ulcers are alſo waſhed with the decoction, and the Indians are ſaid to ſprinkle them with the powder of the inner bark of the ſpruce tree. The ſame ſtrictneſs of regimen is ordered as during a ſalivation or mercurial courſe. The benefit to be derived from this article has not, as far as we know, been confirmed either in Britain or by the practitioners in Virginia: for there, as well as in Britain, recourſe is almoſt univerſally had to the uſe of mercury; and it is probably from this reaſon that the London college have not received it in their liſt. It, however, ſeems to be an article which, in ſome caſes at leaſt, deſerves a trial.

LOBETUM, anciently a town of the Hither Spain: ſaid to have been built by the Libyan Hercules, (Pliny.) Now *Albarazin*, a town of Arragon on the confines of New Caſtile, on the river Guadalavir. E. long. 2. N. lat. 40. 40.

LOBINEAU (Guy Alexis), a Benedictine monk, born at Rennes in 1666, ſpent his whole life in the ſtudy of hiſtory, and the writing of ſeveral works; the principle of which are, The hiſtory of Brittany, 2 vols folio; and A continuation of Felibien's hiſtory of Paris. 9 vols folio. He died in 1727.

LOBO (Rodriguez Francis), a celebrated Portugueſe poet, was born at Leiria, a ſmall town of Eſtramadura. He wrote an heroic poem, ſome eclogues, and a piece intitled *Euphroſyne*, which is the favourite comedy of the Portugueſe. His works were collected and printed together in Portugueſe in 1721, in folio. He flouriſhed about 1610.

LOBO (Jerome), a famous Portugueſe Jeſuit, born at Liſbon, went into Ethiopia, and dwelt there for a long time. At his return he was made rector of the college of Coimbra, where he died in 1678. He wrote An hiſtorical account of Abyſſinia, which is by ſome eſteemed a very accurate performance.

LOBSTER, in zoology, a ſpecies of cancer. See CANCER.

LOCAL, in law, ſomething fixed to the freehold, or tied to a certain place: thus, real actions are local, ſince they muſt be brought in the country where they lie; and local cuſtoms are thoſe peculiar to certain countries and places.

LOCAL Medicines, thoſe deſtined to act upon particular parts; as fomentations, epithems, veſicatories, &c.

LOCARNO, a town of Switzerland, capital of a bailiwick of the ſame name, ſeated at the north end of the lake Maggiore, near the river Magie. It carries on a great trade; and the country abounds in paſtures, wine, and fruits. E. Long. 8. 41. N. Lat. 46. 6.

LOCATELLUS's Balsam. See Pharmacy-*Index*.

LOCHABER, a diſtrict of the ſhire of Inverneſs in Scotland. It is bounded by Moydart on the weſt, Glengary on the north, Badenoch on the eaſt, and Lorn on the ſouth. It derives its name from the lake or loch Aber; and extends about 20 miles from eaſt to weſt, and 30 from north to ſouth. The country is barren, bleak, mountainous and rugged. In one of the moſt barren parts of this country, near the mouth of the river Aber, in the centre between the Weſt and North Highlands, ſtands Fort-William, with the town of Maryburgh, built upon a navigable arm of the ſea, not far from the foot of a very high mountain, called *Benevis*. The town, deſigned as a ſutlery for the garriſon, was erected into a borough; and the fort itſelf was deſigned as a check upon the clan Cameron, who had been guilty of depredations and other irregularities. It is inhabited moſtly by the Macdonalds, Camerons, and Mackintoſhes; who are not the moſt civilized people in Scotland, though their chiefs are generally perſons of education, honour, and hoſpitality. Macdonald of Glengary, deſcended in a ſtraight line from Donald of the Iſles, poſſeſſed a ſeat or caſtle in this diſtrict, which was burnt to the ground, and deſtroyed in the year 1715, in conſequence of his declaring for the Pretender. The elegant houſe and gardens belonging to Cameron of Lochiel underwent the ſame fate, for the ſame reaſon, after the extinction of the rebellion in the year 1746. The cadets of theſe families, which have formed a kind of inferior gentry, are lazy, indigent, and uncleanly; proud, ferocious, and vindictive. The common people, though celebrated for their bravery, fidelity, and attachment to their chiefs, are counted very ſavage, and much addicted to rapine. They ſpeak the Erſe language, and conform to the cuſtoms we have deſcribed as peculiar to the Highlanders. They pay very little attention to any ſort of commerce but that which conſiſts in the ſale of their black cattle, and lead a ſort of vagrant life among the hills; hunting, fowling, and fiſhing, as the ſeaſons permit, and as their occaſions require. They delight in arms, which they learn to handle from their infancy; ſubmit patiently to diſcipline in the character of ſoldiers; and never fail to ſignalize themſelves in the field by their ſobriety, as well as their valour. While they remain in their own country, nothing can be more penurious, mean, ſordid, and uncomfortable, than the way of life to which theſe poor people are inured, whether we conſider their dreſs, diet, or lodging. In point of proviſion, they are ſo improvident or ill ſupplied, that, before the winter is over, whole families are in danger of ſtarving. In this emergency, they bleed their miſerable cattle, already reduced to ſkin and bone, and eat the blood boiled with oatmeal. This evacuation, added to their former weakneſs, enfeebles the cows to ſuch a degree, that when they lie down they cannot riſe again without aſſiſtance.

LOCHIA, in midwifery, a flux from the uterus conſequent to delivery. See Midwifery.

LOCK, a well-known inſtrument uſed for faſtening doors, cheſts, &c. generally opened by a key.

The lock is reckoned the maſter-piece in ſmithery; a great deal of art and delicacy being required in contriving and varying the wards, ſprings, bolts, &c. and adjuſting them to the places where they are to be uſed, and to the various occaſions of uſing them.

From the various ſtructure of locks, accommodated to their different intentions, they acquire various names. Thoſe placed on outer-doors are called *ſtock-locks*; thoſe on chamber-doors, *ſpring-locks*; thoſe on trunks, *trunk-locks*, *pad-locks*, &c.

Of theſe the ſpring-lock is the moſt conſiderable, both for its frequency and the curioſity of its ſtructure. Its principal parts are, the main plate, the cover plate, and the pin-hole: to the main-plate belong the key-hole, top-hook, croſs-wards, bolt toe or bolt-knab, drawback-ſpring tumbler, pin of the tumbler, and the ſtaples; to the cover-plate belong the pin, main-ward, croſs-ward, ſtep-ward or dap-ward; to the pin-hole belong the hook-ward, main croſs-ward, ſhank, the pot or bread, bow-ward, and bit.

As on the proper conſtruction of locks the ſecurity of the moſt valuable kinds of property almoſt entirely depends, and as numberleſs devices are continually fallen upon to elude the utmoſt efforts of mechanical invention in this reſpect, it thence becomes an object of no ſmall importance to invent a lock which it ſhould be *impoſſible* to open except by its proper key. A treatiſe upon this ſubject has been publiſhed by Mr Joſeph Brama; who is confident that he has brought the matter to the requiſite perfection, and that every one may reſt aſſured of the ſecurity of his property when under the protection of a lock of his invention. He begins with obſerving, that the principle on which all locks depend, is the application of a lever to an interior bolt, by means of a communication from without; ſo that, by means of the latter, the lever acts upon the bolt, and moves it in ſuch a manner as to ſecure the lid or door from being opened by any pull or puſh from without. The ſecurity of locks in general therefore depends on the number of impediments we can interpoſe betwixt the lever (the key) and the bolt which ſecures the door; and theſe impediments are well known by the name of *wards*, the number and intricacy of which alone are ſuppoſed to diſtinguiſh a good lock from a bad one. If theſe wards, however, do not in an effectual manner preclude the acceſs of *all* other inſtruments beſides the proper key, it is ſtill poſſible for a mechanic of equal ſkill with the lock-maker to open it without the key, and thus to elude the labour of the other.

"Locks (ſays our author) have been conſtructed, and are at preſent much uſed and held in great eſteem, from which the picklock is excluded: but the admiſſion of falſe keys is an imperfection for which no lock-ſmith has ever found a corrective; nor can this imperfection be remedied whilſt the protection of the bolt is wholly confined to *fixed wards*." This poſition is proved by a remark, that the wards, let them be as intricate as we pleaſe, muſt all be expreſſed on what is called the *bit* or *web* of the key: and therefore, when all the varieties that can be expreſſed on this bit or web have been run through, every ſucceeding lock muſt be the counterpart of ſome other; and conſequently the

the

ſame key which opens one will open the other alſo. This is evident from the locks uſually put upon drawers; and which, tho' they ſhould be made to reſiſt the picklock, are ſtill liable to be opened by ten thouſand other keys beſides that appropriated to each of them. But though the variety of wards could be augmented even to infinity, ſtill there could be no ſecurity againſt falſe keys for as every one of the wards muſt be expreſſed on the web of the key, if another key with a web quite plain be made to fit the key-hole exactly, we have only to cover it over with ſome colouring ſubſtance upon which the wards may make an impreſſion; after which, it is eaſy to cut out the web in a proper manner for admitting them, when the lock will be as eaſily opened by the falſe as by the true key.

The firſt perſon, according to our author, who had any claim to merit in the branch of lock-making, is Mr Baron; whoſe lock he acknowledges to be by far more perfect and ſecure than any that ever appeared before; though he ſtill conſiders it as unfit for giving that abſolute ſecurity which is to be wiſhed for. His improvement conſiſted in the proper application of what are called *tumblers*. "Theſe (ſays Mr Bramah) are a kind of grapple; by which the bolt is confined, as well in its active as in its paſſive ſtation, and rendered immoveable till ſet at liberty by the key. One of theſe inſtruments is commonly introduced into all locks that are of any uſe or value; it is lodged behind the bolt, and is governed by a ſpring which acts upon the tumbler as the tumbler acts upon the bolt: The application therefore of any force to the tumbler, which is ſuperior to the force of the ſpring, will cauſe it to quit its hold, and ſet the bolt at liberty." In the common method of applying thſe machines, however, it matters nothing how far the tumbler is lifted above the point at which it ceaſes to control the bolt; but it is otherwiſe in thoſe of Mr. Baron's conſtruction. The action of his tumblers is circumſcribed by a certain ſpace cut in the centre of the bolt, of dimenſions ſufficient only to anſwer the purpoſe intended. The ſpace in which the tumbler moves is an oblong ſquare; and is not only furniſhed with niches on the underſide into which the hooks of the tumblers are forced by the ſpring as in other locks, but is provided with correſpondent niches on the other ſide, into which the hooks are driven, if any greater force be applied to the tumblers than what is juſt ſufficient to diſengage them from the bolt. Hence it becomes abſolutely neceſſary, in the making of a falſe key, to conſtruct it in ſuch a manner, that it may with the greateſt exactneſs give the requiſite degree of preſſure, and no more.

Mr. Bramah allows that this is a very great improvement, but objects that it is ſtill poſſible to frame a key which will open it as well as its own; nor will the addition of any number of tumblers preclude the poſſibility of opening it. "By giving (ſays he) an uniform motion to the tumblers, and preſenting them with a face which exactly tallies with the key, they ſtill partake, in a very great degree, of the nature of *fixed wards*; and the ſecurity of his lock is thereby rendered in a proportionable degree defective. Thus, ſuppoſe the falſe key to have paſſed the wards, and to be in contact with the moſt prominent of the tumblers, the impreſſion, which the ſlighteſt touch will leave on the key, will direct the application of the file till ſufficient ſpace is prepared to give a free paſſage. The key will then bear upon a more remote tumbler; which difficulty being in like manner got over, the lock will be as eaſily opened by the falſe as by the true key."

This ſeemingly inſuperable objection to the perfection of lock-making, however, our author removes with the greateſt eaſe imaginable, by cauſing the tumblers which project unequally to preſent a *plane* ſurface: whence they would require a ſeparate and unequal motion to diſengage them; of conſequence, no diſtinct impreſſion could be made by them upon the plane ſurface of the web that would give any idea of their poſitions with regard to one another, and the conſtruction of a falſe key would be altogether impoſſible.

But though the principal difficulty with regard to Mr Baron's lock be now overcome, others ſtill occur, *viz.* the difficulty of making locks which are conſtructed with tumblers ſufficiently durable. The tumblers themſelves, he obſerves, muſt be but ſlightly made: and being expoſed to perpetual friction by the key and their own proper motion, they muſt ſoon decay; and the keys of Mr Baron's locks, he alſo obſerves, are much leſs durable than thoſe of any other locks he ever ſaw.

With regard to the lock which Mr Bramah preſents to the public as abſolutely perfect, he informs us, that the idea of conſtructing it was firſt ſuggeſted by the alarming increaſe of houſe-robberies, which may reaſonably be ſuppoſed to be perpetrated in a great meaſure by perfidious ſervants, or accompliſhed by their connivance. Thus it is evident, that the locks which might exclude ordinary houſe-breakers could be no ſecurity againſt faithleſs ſervants, who having conſtant acceſs to the locks might eaſily get falſe keys fabricated at their leiſure. In conſidering the ſubject, our author was convinced, that his hope of ſucceſs depended entirely upon his uſing means as diſſimilar as poſſible to thoſe by which the old locks were conſtructed; as theſe, however varied, had been found inſufficient for the purpoſe. "As nothing, (ſays he) can be more oppoſite in principle to *fixed wards* than a lock which derives its properties from the *motion* of all its parts, I determined that the conſtruction of ſuch a lock ſhould be the ſubject of my experiment." In the proſecution of this experiment he had the ſatisfaction to find, that the leaſt perfect of all his models fully aſcertained the truth and certainty of his principle. The excluſion of wards made it neceſſary to cut off all communication between the key and the bolt; as the ſame paſſage, which (in a lock *ſimply* conſtructed) would admit the key, might give admiſſion likewiſe to other inſtruments. The office, therefore, which in other locks is performed by the extreme point of the key, is here aſſigned to a lever, which cannot approach the bolt till every part of the lock has undergone a change of poſition. The neceſſity of this change to the purpoſes of the lock, and the abſolute impoſſibility of effecting it otherwiſe than with the proper key, are the points to be aſcertained; and this our author does in the following manner.

Plate CCLXXII.

Fig. 1. Shows Mr Bramah's firſt attempt to conſtruct a lock upon this principle: which, to his ſurpriſe, turned out complete and perfect. *A* repreſents a common axis on which the ſix levers, croſſing the face

face of the lock, are united as on a joint. Each of theſe reſts upon a ſeparate ſpring ſufficiently ſtrong to bear its weight ; or, if depreſſed by a ſuperior force, to reſtore it to its proper poſition when that force is removed. B repreſents a frame through which the levers paſs by ſeparate grooves, exactly fitted to their width, but of ſufficient depth to allow them a free motion in a perpendicular direction. The part which projects from the oppoſite ſide of the joint A, and is inſerted in the bolt C, is a lever to which two offices are aſſigned ; one to keep the bolt in a fixed poſition, in the abſence of the key ; the other, to give it its proper motion upon the application of the key. D is a circular platform turning upon a centre. On this the joint or carriage of the levers, and the ſprings on which they reſt, are fixed ; and the motion of this platform impels the bolt, in either direction, by means of the lever which is projected from the joint A. The inviolable reſtraint upon this lock, by which means it is ſubjected only to the action of the key, is lodged in the part E, which is a thin plate, bearing at each extremity on a block, and having of courſe a vacant ſpace beneath, equal in height to the thickneſs of the blocks on which it reſts. By this plate the motion of the machine is checked or guided in the following manner: On the edge of the plate which faces the movement there are ſix notches, which receive the ends of the levers projecting beyond the frame B ; and while they are confined in this manner, the motion of the machine is ſo totally ſuſpended as to defy every power of art to overcome.

To underſtand in what manner the proper key of this lock overcomes theſe obſtacles, it muſt be obſerved, that each lever has a notch on its extremity, and that thoſe notches are diſpoſed as irregularly as poſſible. To give the machine a capacity of motion, theſe notches, muſt be brought parallel to each other, and by a diſtinct but unequal preſſure upon the levers, be formed into a groove in a direct line with the edge of the plate E, which the notches are exactly fitted to receive. The leaſt motion of the machine, while the levers are in this poſition, will introduce the edge of the plate into the groove ; which, controuling the power of the ſprings, will give liberty to the levers to move in an horizontal direction as far as the ſpace between the blocks which ſupport the plate E will admit, and which is ſufficient to give the machine a power of acting on the bolt. The impoſſibility of thus bringing the notches on the points of the levers into a direct line, ſo as to tally with the edge of the plate E by any other means than the motion and impulſe of the key, is that which conſtitutes the principal excellency of this lock.

The key (fig. 2.) exhibits ſix different ſurfaces, againſt which the levers are progreſſively admitted in the operation of opening the lock : the irregularity of theſe ſurfaces ſhows the unequal and diſtinct degree of preſſure which each lever requires to bring them to their proper bearings, in order to put the machine in motion. Hence it appears, that unleſs the various heights of the ſurfaces expreſſed on the bit of the key are exactly proportioned to the ſeveral diſtances neceſſary to bring the notches into a ſtraight line with each other, they muſt remain immoveable ; " and (ſays our author) as one ſtroke of a file is ſufficient to cauſe ſuch diſproportion as will prove an unſurmountable impediment to their motion, I may ſafely aſſert, that it is not in art to produce a key or other inſtrument, by which a lock, conſtructed upon this principle, can be opened."

On this principle it would even be a matter of great difficulty for any workman, however ſkilful, to conſtruct a key for the lock when open to his inſpection : " for the levers being raiſed, by the ſubjacent ſprings, to an equal height in the frame B, preſent a *plane* ſurface ; and conſequently convey no direction that can be of any uſe in forming a tally to the *irregular* ſurface which they preſent when acting in ſubjection to the key. Unleſs therefore we can contrive a method to bring the notches on the points of the levers in a direct line with each other, and to retain them in that poſition till an exact impreſſion of the irregular ſurface, which the levers will then exhibit, can be taken ; the workman will be unable to fit a key to the lock, or to move the bolt. This proceſs muſt be rendered extremely troubleſome by means of the ſprings ; and if ſuch difficulties occur, even when the lock is open to the inſpection of a ſkilful workman, much more muſt we ſuppoſe it out of the power of one who has not acceſs to the internal parts to make a falſe key to a lock of this kind.

Theſe difficulties render it neceſſary in making locks of this kind not to fit the key to the lock, as is uſual in other locks, but to fit the lock to the key. In this kind of lock, therefore, the key muſt be made firſt ; and the inequalities upon the ſurface of the bit worked as chance or fancy may direct, without any reference to the lock. The key being thus completed, and applied to the ſurface of the levers, will, by a gentle preſſure, force them to unequal diſtances from their common ſtation in the frame B, and ſink their points to unequal depths into the ſpace beneath the plate E. While the levers are in this poſition, the edge of the plate E will mark the preciſe point at which the notch on each lever muſt be expreſſed. The notches being cut by this direction, the irregularity which appears when the levers reſume their ſtation in the frame B, and the inequality of the receſſes on the bit of the key, will appear as a ſeal and its correſponding impreſſion.

The following is a lock contrived upon the ſame principle, but more curious ; and, in our author's opinion, more extenſively uſeful. Fig. 3. repreſents a circular block of metal divided from the centre into eight compartments, each containing a cell which forms a paſſage through the block, as is repreſented by the ſmall circles deſcribed on the flat ſurface A. In each of theſe cells two grooves are cut at oppoſite points, which open a communication with the centre at one point, and with the ſpherical ſurface of the block or barrel at the other. The ſmall circle, which marks the centre of the flat ſurface A, is the key-hole, which likewiſe forms a paſſage through the barrel in a parallel line with the cells which ſurround it. This figure repreſents the frame in which the active parts of the lock are depoſited.

Fig. 4. ſhows a ſpiral ſpring lodged in the bottom of each cell, and occupying one half of the ſpace, the other being filled with a ſlider reſting upon the ſpring, and repreſented by fig. 5. the office of theſe ſliders ex-

actly correſponding with that of the levers in the lock already deſcribed. Thus, when lodged in their reſpective cells, they are ſuſtained, like the levers, by the elaſticity of the ſprings upon which they reſt, till a ſuperior power be applied; and they are again reſtored to their ſtations by the reaction of the ſprings when the weight is removed. The ſide B of each ſlider is projected beyond the circular ſurface, as repreſented fig. 6. in a manner ſimilar to the projection of the levers in the former lock beyond the curved frame in which they move. The point C is projected through the interior groove into the ſpace which forms the centre or key-hole, expreſſed on the flat ſurface A.

Fig. 7. repreſents the key. When this is applied, it muſt of courſe encounter theſe interior projections; and when preſſed forward, the indented ſpaces on its point being unequal, will force the ſliders to unequal diſtances from their bearers; bringing the notches expreſſed on their exterior projections in a direct line with each other, in a manner ſimilar to that by which the effect is produced upon the levers in the former lock. When the key is withdrawn, and the ſliders reſume their ſtations by the preſſure of the ſprings, the diſpoſition of the notches muſt be irregular in the ſame proportion that the indentations on the point of the key are unequal; and they muſt neceſſarily fall again into a ſtraight line when acted upon by the key.

Fig. 6. ſhows the barrel completely fitted for action. Its interior end is caped with a plate, which unites its compartments, and confines the ſprings and ſliders within the cells to which they belong. From that plate proceeds the point A, which repreſents the lever by which the bolt is projected or withdrawn, according to the direction in which the machine performs its revolution.

Fig. 8. ſhows the flat ſurface of a thin plate, correſponding in its office with the part C of the former lock. The ſpace cut in its centre is exactly fitted to the ſpherical ſurface of the barrel; the circle deſcribing its circumference, and the notches cut on its edge, coinciding with the projections of the ſliders. The barrel, when encircled with this plate at the middle of its ſpherical ſurface, has its motion totally ſuſpended till the notches on the projections of the ſliders are forced, by the preſſure of the key, into a line with each other: a groove being thus formed on the ſpherical ſurface of the barrel parallel to, and coinciding with, the edge of the plate, the machine is at liberty to perform a revolution in any direction, but returns to its confined ſtate when the key is withdrawn.

The parts of the movement being thus united, the interior end of the barrel is depoſited in a bed repreſented fig. 9. To this it is faſtened at the angles of the plate repreſented fig. 8. by which the barrel is encircled. The ſtation of the bolt is at A; the lever which acts upon it being projected on the other ſide. Fig. 10. is a cap or maſk which covers the face of the movement, and completes the lock.

On this lock our author obſerves, that it is excellent for ſtreet-doors: "for no method of robbery (ſays he) is more practiſed, than gaining admittance into houſes by thoſe keys, which, as is well known, may be procured at the old iron ſhops to fit almoſt any lock in uſe. Such robberies are generally committed where the ſervants are allowed to take the key with them when ſent on errands, it being impracticable while the key is fixed in the lock. The variations, by which the production of correſpondent keys is avoided, have two ſources: the one ariſing from the changes that may be made in the diſpoſition of the levers; the other, from the number of points contained on the projected ſurface of each lever; by which the poſition of its notch may, in the ſmalleſt degree, be varied.

"The variations, produceable in the diſpoſitions of ſix figures only, are 720: theſe, being progreſſively multiplied by additional figures, will increaſe by aſtoniſhing degrees; and eventually ſhow, that a lock containing twelve levers will admit of 479,001,500 changes; which, with the addition of another lever, will increaſe to 6,229,019,500. Theſe being again multiplied by the number of changes which the projected ſurface of the levers will admit in the diſpoſition of the notches, their amount will exceed numeration, and may therefore be properly ſaid to be infinite. The ſlighteſt inſpection will at once ſhow, that their conſtruction precludes all poſſibility of obtaining an impreſſion of their internal parts, which is neceſſary for the fabrication of a falſe key; for it will be eaſily ſeen, that the poſitions into which the levers are forced by the preſſure of the key in opening the lock, can no more be aſcertained when the key is withdrawn, than the ſeal can be copied from its impreſſion on a fluid, or the courſe of a ſhip be diſcovered by tracing it on the ſurface of the waves. But inviolable ſecurity is not the only excellence they poſſeſs; the ſimplicity of their principle gives them likewiſe a great advantage over locks that are more complicated, in point of duration; for their eſſential parts being ſubject to no friction, nor expoſed to any poſſible accident from without, they will be leſs affected by uſe, and leſs liable to ſtand in need of repair."

Lock, or *weir*, in inland navigations, the general name for all thoſe works of wood or ſtone made to confine and raiſe the water of a river: the banks alſo which are made to divert the courſe of a river, are called by theſe names in ſome places. But the term *lock* is more particularly appropriated to expreſs a kind of canal incloſed between two gates; the upper called by workmen the ſluice-gate, and the lower called the flood-gate. Theſe ſerve in artificial navigations to confine the water, and render the paſſage of boats eaſy in paſſing up and down the ſtream. See Canal.

LOCKE (John), a moſt eminent Engliſh philoſopher and writer in the latter end of the 17th century, was ſon of Mr John Locke of Pensford in Somerſetſhire, and born at Wrington near Briſtol in 1632. He was ſent to Chriſt-church in Oxford; but was highly diſſatisfied with the common courſe of ſtudies then purſued in the univerſity, where nothing was taught but the Ariſtotelian philoſophy; and had a great averſion to the diſputes of the ſchools then in uſe. The firſt books which gave him a reliſh for philoſophy, were the writings of Des Cartes: for though he did not always approve of his notions, yet he thought he wrote with great perſpicuity. He applied himſelf with vigour to his ſtudies, particularly to phyſic in which he gained a conſiderable knowledge, though he never practiſed it. In 1694, he went to Germany as ſecretary to Sir William Swan, envoy from the Engliſh court to the elector of Brandenburg and ſome

Plate CCLXXII

Lock

Fig. 1

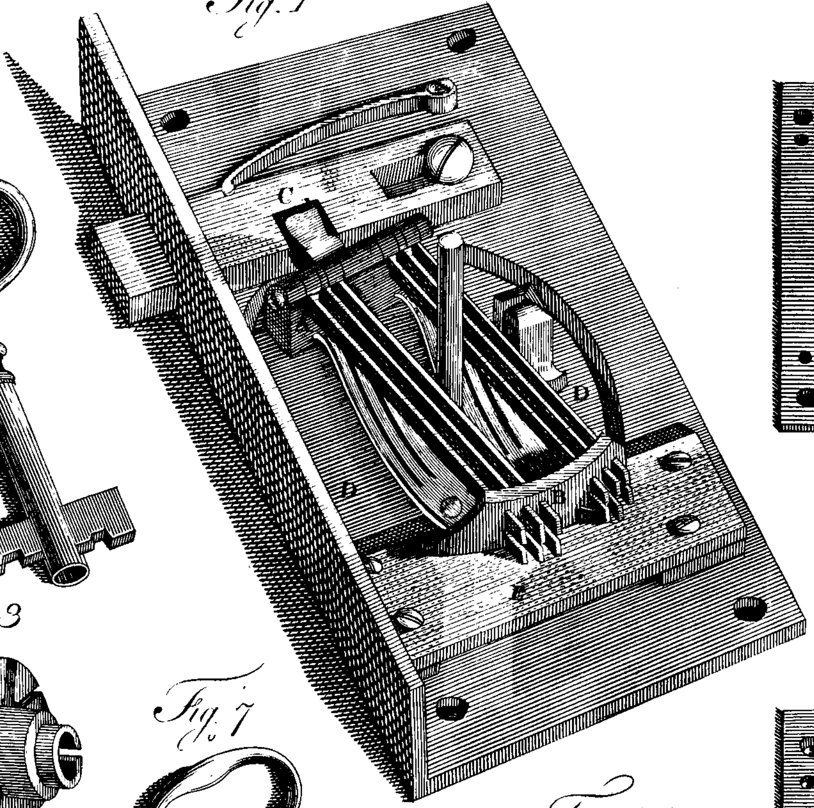


Fig. 2

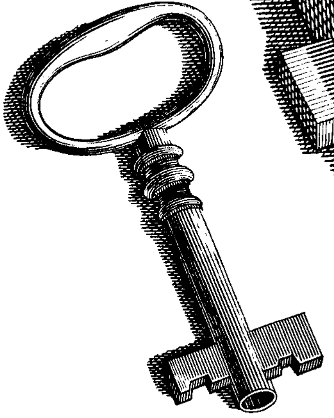


Fig. 8

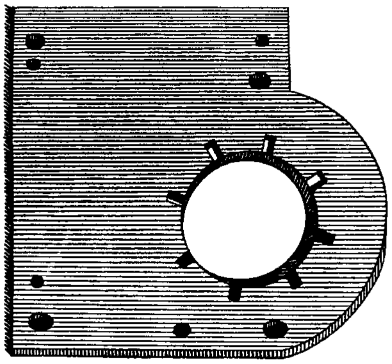


Fig. 3

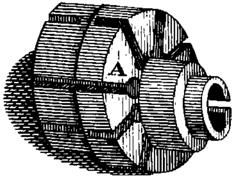


Fig. 7

Fig. 10

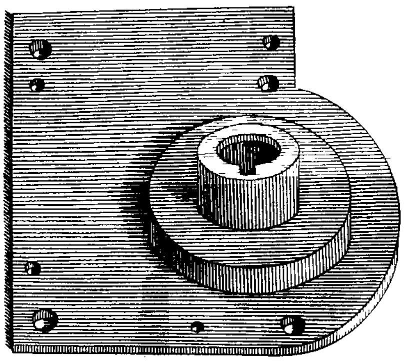


Fig. 6

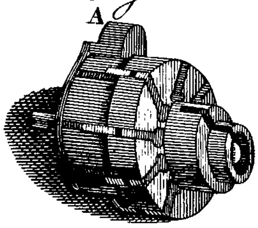


Fig. 4

Fig. 5

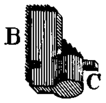
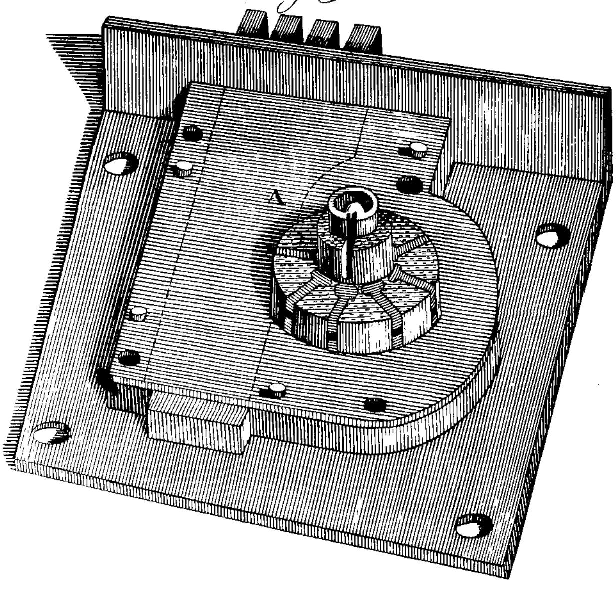
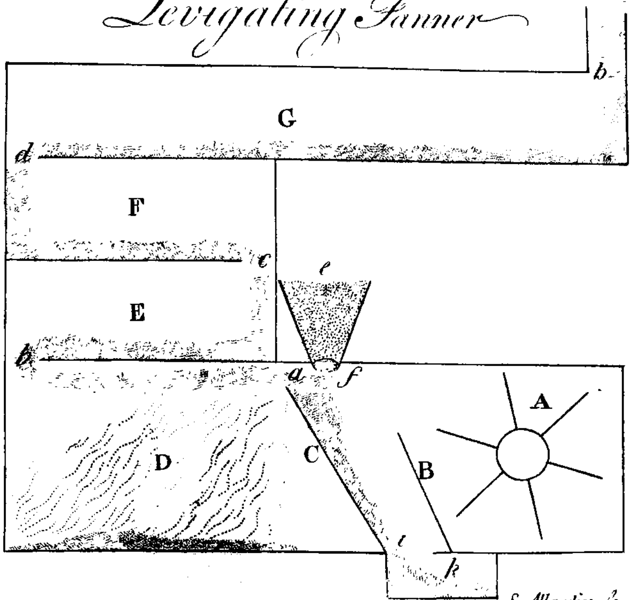


Fig. 9



Levigating Fanner



S. Allardice sc.

other German princes. In leſs than a year, he returned to England; where, among other ſtudies, he applied himſelf to that of natural philoſophy, as appears from a regiſter of the changes of the air which he kept at Oxford from June 24. 1666, to March 28. 1667. There he became acquainted with the lord Aſhly, afterwards earl of Shafteſbury, who introduced him into the converſation of ſome of the moſt eminent perſons of that time. In 1670, he began to form the plan of his *Eſſay* on *Human Underſtanding*; but his employments and avocations prevented him from finiſhing it then. About this time he became a member of the Royal Society. In 1672, his patron, now earl of Shafteſbury, and lord chancellor of England, appointed him ſecretary of the preſentations, which place he held till the earl reſigned the great ſeal. In 1673, he was made ſecretary to a commiſſion of trade, worth 500l. a-year; but that commiſſion was diſſolved in 1674. The earl of Shafteſbury being reſtored to favour, and made preſident of the council in 1679, ſent for Mr Locke to London: but that nobleman did not continue long in his poſt, being ſent priſoner to the tower; and after his diſcharge retired to Holland in 1682.

Mr Locke followed his patron thither. He had not been abſent from England a year, when he was accuſed at court of having written certain tracts againſt the government, which were afterwards diſcovered to be written by another perſon; and in November 1684, he was deprived of his place of ſtudent in Chriſt-church. In 1685, the Engliſh envoy at the Hague demanded him and 83 other perſons to be delivered up by the States General: upon which he lay concealed till the year following; and during this time formed a weekly aſſembly with Mr Limborch, Mr Le Clerc, and other learned men at Amſterdam. In 1689 he returned to England in the fleet which conveyed the princeſs of Orange; and endeavoured to procure his reſtoration to his place of ſtudent of Chriſt-church, that it might appear from thence that he had been unjuſtly deprived of it: but when he found the college would admit him only as a ſupernumerary ſtudent, he deſiſted from his claim.

Being eſteemed a ſufferer for revolution-principles, he might eaſily have obtained a more profitable poſt; but he contented himſelf with that of commiſſioner of appeals, worth 200l. a year, which was procured for him by the lord Mordaunt, afterwards earl of Monmouth, and next of Peterborough. About the ſame time he was offered to go abroad in a public character; and it was left to his choice whether he would be envoy at the court of the emperor, that of the elector of Brandenburgh, or any other where he thought the air moſt ſuitable to him: but he waved all theſe, on account of the infirm ſtate of his health; which diſpoſed him gladly to accept another offer that was made by Sir Francis Maſham and his lady, of an apartment in their country-ſeat at Oates in Eſſex, about 25 miles from London.

This place proved ſo agreeable to him in every reſpect, that it is no wonder he ſpent the greateſt part of the remainder of his life at it. The air reſtored him almoſt to a miracle, in a few hours after his return at any time from the town quite ſpent and unable to ſupport himſelf. Beſides this happineſs here, he found in lady Maſham a friend and companion exactly to his heart's wiſh; a lady of contemplative and ſtudious complexion, and particularly inured, from her infancy, to deep and refined ſpeculation in theology, metaphyſics, and morality. In this family Mr Locke lived with as much eaſe as if the whole houſe had been his own; and he had the additional ſatisfaction of ſeeing this lady breed up her only ſon exactly upon the plan which he had laid down for the beſt method of education; the ſucceſs of which was ſuch as ſeemed to give a ſanction to his judgment in the choice of that method. In effect, it is to the advantage of this ſituation that he derived ſo much ſtrength as to continue exerting thoſe talents which the earl of Shafteſbury had obſerved to be in him for political ſubjects. Hence we find him writing in defence of the revolution in one piece; and conſidering the great national concern at that time, the ill ſtate of the ſilver coin, and propoſing remedies for it in others. Hence he was made a commiſſioner of trade and plantations in 1695, which engaged him in the immediate buſineſs of the ſtate; and with regard to the church, he publiſhed a treatiſe the ſame year, to promote the ſcheme which king William had much at heart, of a comprehenſion with the diſſenters. This, however, drew him into one controverſy; which was ſcarcely ended, when he entered into another in defence of his eſſay, which held till 1698: ſoon after which the aſthma, his conſtitutional diſorder, increaſing with his years, began to ſubdue him; and he became ſo infirm, that in 1700 he reſigned his ſeat at the board of trade, becauſe he could no longer bear the air of London ſufficient for a regular attendance upon it. After this reſignation he continued altogether at Oates; in which retirement he employed the remaining laſt years of his life entirely in the ſtudy of the holy Scriptures.

He died in 1704, aged 73. His writings will immortalize his name. The earl of Shafteſbury, author of the Characteriſtics, though in one place he ſpeaks of Mr Locke's philoſophy with ſeverity; yet obſerves, concerning his Eſſay on the Human Underſtanding, in general, "that it may qualify men as well for buſineſs and the world, as for the ſciences and the univerſity." Whoever is acquainted with the barbarous ſtate of the philoſophy of the human mind, when Mr Locke undertook to pave the way to a clear notion of knowledge, and the proper methods of purſuing and advancing it, will be ſurpriſed at this great man's abilities; and plainly diſcover how much we are beholden to him for any conſiderable improvements that have been made ſince. His Diſcourſes on Government, Letters on Toleration, and his Commentaries on ſome of St Paul's Epiſtles, are juſtly held in the higheſt eſteem.

LOCKED JAW. See (the *Index* ſubjoined to) MEDICINE.

LOCKMAN, an officer in the Iſle of Man, who executes the orders of government, much like our under-ſheriff.

LOCKMAN, an eaſtern philoſopher. See LOKMAN.

LOCLE, a ſmall town in a diſtrict of the ſame name in Switzerland, adjacent to Neufchatel and Vallengin, and united with another named *La Chaux de Fond*. Both theſe diſtricts occupy ſome valleys formed by the mountains of Jura; the greateſt part of which

which not many years ago was one continued foreſt, though now converted into fine paſture-ground filled with flouriſhing villages. The increaſe of population in theſe diſtricts is particularly evident from the following circumſtance, *viz*. that formerly the produce of the country was more than ſufficient to ſerve the inhabitants; but now, though conſiderably better cultivated, it ſcarce furniſhes an eighth part of the neceſſary conſumption. This great increaſe of numbers is owing to the early marriages of the inhabitants; to the liberty allowed to every ſtranger, who brings a certificate of his good behaviour, to ſettle in the diſtrict; to follow any trade without reſtriction, and without an apprenticeſhip; and to the want of taxes, and an unbounded freedom of commerce. The induſtry and genius of the people in theſe diſtricts is very ſurpriſing. They carry on an extenſive commerce in lace, ſtockings, cutlery, and other merchandiſe of their own manufacture; and particularly excel in every branch of watch and clock making. They make all the utenſils neceſſary in theſe arts, and have invented ſeveral new ones. There are alſo in theſe diſtricts painters, gilders, enamellers, engravers, and other artiſts neceſſary for completing the buſineſs of watch making; by which means that buſineſs is carried on to ſo great an extent, that 40,000 watches are computed to be annually made. Beſides theſe arts already mentioned, the people are extremely ingenious in other branches of mechanics, and have invented ſeveral aſtronomical and mathematical inſtruments. One of the moſt eminent in this way is Jaquet Droz, now at Paris; and whoſe ſon exhibited ſeveral ſurpriſing automatical figures in England. One of theſe played upon a harpſichord: another drew landſcapes; and a third copied any word preſented to it, or wrote down whatever was dictated by any of the company.

The inhabitants of theſe diſtricts are very courteous to ſtrangers who viſit them; they are in general well informed in ſeveral branches of knowledge; and as they commonly employ their leiſure hours in reading, they have circulating libraries in many of their villages. Their houſes are plaſtered, white waſhed, well built, and commodious, though ſmall; being beſides furniſhed with a degree of neatneſs and even elegance peculiarly ſtriking in theſe ſequeſtered mountains. "Such perfect eaſe and plenty (ſays Mr Coxe) reigns throughout theſe mountains, that I ſcarcely ſaw one object of poverty: the natural effects of induſtry under a mild and equitable government."

LOCRI, or *Locri Epizephyrii*, (anc. geog.), a town of the Brutii, on the Ionian ſea: a colony of the Locri Ozolæ (Strabo); rather of the Epicnemidii (Virgil), who calls it *Narycii Locri*, from Naryx a town of the Locri Epicnemedii. The epithet *Epizephyrii* is from its ſituation near the promontory Zephyrium (Strabo); *Locri* and *Locrenſes*, the people. They are ſaid to be the firſt who uſed a code or body of written laws, compiled by Zaleucus from the laws of the Cretans, Lacedemonians, and the Areopagitæ, adding an expreſs penalty to each law, which was before diſcretionary, at the option of the judge (Strabo). Adultery was puniſhed with the loſs of both eyes. His own ſon being convicted of this crime; to maintain at the ſame time the authority of the law, and to pay ſome regard to the interceſſion of the people in favour of his ſon, Zaleucus ſuffered the loſs of an eye, his ſon loſing another (Ælian, Val. Maximus.)

LOCRIS, the diſtrict or territory of Locri in the Bruttii in Italy.

LOCRIS, a country of Achaia in Greece; twofold, and divided by mount Parnaſſus. The Hither was occupied by the Locri Ozolæ, called alſo *Zephyrii*, or Weſtern, contained between Ætolia and Phocis, beginning at Naupactum, and running in a narrow ſlip of land, ſcarce 200 ſtadia, along the ſea to the borders of the Phocenſes. The farther Locris lay beyond Parnaſſus, running out towards Thermopylæ, and reaching to the Euripus of Eubœa; occupied by the Locri Opuntii, who dwelt on the Eubœan ſea; and the Epicnemidii, who occupied mount Cnemis (Strabo); and theſe two were the Eaſtern Locri.

LOCUS GEOMETRICUS, denotes a line by which a local or indeterminate problem is ſolved.

A *locus* is a line, any point of which may equally ſolve an indeterminate problem. Thus if a right line ſuffice for the conſtruction of the equation, it is called *locus ad rectum*; if a circle, *locus ad circulum*; if a parabola, *locus ad parabolam*; if an ellipſis, *locus ad ellipſim*: and ſo of the reſt of the conic ſections.

LOCULAMENTA, and LOCULI, in botany; cells or pockets: The internal diviſions of a capſule, or other dry ſeed-veſſel, ſo termed.—Theſe cells contain or incloſe the ſeeds; and are different in number in different plants.

The term LOCULUS is alſo ſometimes uſed to expreſs the minute diviſions in ſome ſpecies of *antheræ*, which contain the fine impalpable powder ſuppoſed by the ſexualiſts to be the principal agent in the generation of plants.

LOCUST, in zoology. See GRYLLUS.

Locust-Eaters. See ACRIDOPHAGI.

American LOCUST, or *Frog-hopper*. See CICADA.

Locust-Tree. See HYMENÆA and GLEDITSIA.

LOCUTIUS, in mythology, the god of ſpeech among the Romans, called by Livy *Aius Locutius*.

LOCUTORIUM. The monks and other religious in monaſteries, after they had dined in their common hall, had a withdrawing-room, where they met and talked together among themſelves, which room, for that ſociable uſe and converſation, they called *locutorium, a loquendo*; as we call ſuch a place in our houſes parlour, from the French *parler*; and they had another room, which was called *locutorium forinſecum*, where they might talk with laymen.

LODGMENT, in military affairs, a work made by the beſiegers in ſome part of a fortification (after the beſieged have been driven out), to maintain it, and be covered from the enemy's fire. When a lodgement is to be made on the glacis, covert way, or in a breach, there muſt be a great proviſion made of faſcines, ſand-bags, gabions, wool-packs, &c. in the trenches; and during the action, the pioneers, under the directon of an engineer, with faſcines, ſand-bags, &c. ſhould be making the lodgment, in order to form a covering, while the grenadiers are ſtorming the covert-way.

LODE, in mining. See LOAD.

LOG, in the Jewiſh antiquities, a meaſure which held a quarter of a cab, and conſequently five-ſixths of a pint. There is mention of a log, 2 Kings vi. 25.

under the name of a *fourth part of a cab*. But in Leviticus the word log is often met with, and ſignifies that meaſure of oil which lepers were to offer at the temple after they were cured of their diſeaſe. Dr Arbuthnot ſays, that the log was a meaſure of liquids, the ſeventy-ſecond part of the bath or ephah, and twelfth part of the hin, according to all the accounts of the Jewiſh writers.

Plate CCLXXIII. fig. 3. LOG, a ſea term, ſignifying a ſmall piece of timber *a*, of a triangular, ſectoral, or quadrantal figure, on board a ſhip, generally about a quarter of an inch thick, and five or ſix inches from the angular point to the circumference. It is balanced by a thin plate of lead, nailed upon the arch, or circular ſide, ſo as to ſwim perpendicularly in the water, with about two thirds immerſed under the ſurface.

Log-Line, a little cord, or line, about a hundred and fifty fathoms long, faſtened to the log by means of two legs *ab* (fig. 4.), one of which paſſes through a hole at the corner, and is knotted on the oppoſite ſide, while the other leg is attached to the arch by a pin fixed into another hole, ſo as to draw out occaſionally. By theſe legs the log is hung in æquilibrio; and the line thus annexed to it is wound round a reel fixed for that purpoſe in the gallery of the ſhip.

This line, from the diſtance of about ten, twelve, or fifteen fathoms off the log, has certain knots or diviſions, which ought to be at leaſt fifty feet from each other; though it was the common practice at ſea not to have them above forty two feet aſunder.

The length of each knot ought to be the ſame part of a ſea-mile as half a minute is of an hour; and admitting the meaſurement of Mr Norwood, who makes a degree on a great circle of the earth to contain 367,200 Engliſh feet, or about $69\frac{1}{2}$ Engliſh ſtatute miles, and, therefore, $\frac{1}{60}$th part of it, or a nautical mile, will be 6120 feet; $\frac{1}{120}$th of 6120, or 51 feet, ſhould be the length of each knot. But becauſe it is ſafer to have the reckoning rather before the ſhip than after it therefore fifty feet may be taken as the proper length of each knot. The knots are ſometimes made to conſiſt only of forty-two feet each, even in the preſent practice; and this method of dividing the log-line was founded on the ſuppoſition that ſixty miles, each of 5000 Engliſh feet made a degree; for $\frac{1}{120}$ of 5000 is $41\frac{1}{3}$, or, in round numbers, 42 feet. Mariners, rather than quit the old way, though known to be erroneous, uſe glaſſes for half minute ones, that run but 24 or 25 ſeconds. They have alſo uſed a line of 45 feet to 30 ſeconds, or a glaſs of 28 ſeconds to 42 feet. When this is the caſe, the diſtance between the knots ſhould be corrected by the following proportion: as 30 is to 50; ſo is the number of ſeconds of the glaſs to the diſtance between the knots upon the line. The heat or moiſture of the weather has often a conſiderable effect upon the glaſs, ſo as to make it run ſlower or faſter; it ſhould, therefore, be frequently tried by the pendulum in the following manner. On a round nail hang a ſtring that has a muſket-ball fixed to one end, carefully meaſuring between the centre of the ball and the ſtring's loop over the peg $39\frac{1}{8}$ inches, being the length of a ſecond pendulum; then ſwing it, and count one for every time it paſſes under the peg, beginning at the ſecond time it paſſes; and the number of ſwings made during the time the glaſs is running out ſhows the ſeconds it contains. The line alſo is liable to relax and ſhrink, and ſhould therefore be occaſionally meaſured.

The uſe of the log and line is to keep account and make an eſtimate of the ſhip's way or diſtance run; which is done by obſerving the length of the line unwound in half a minute's time, told by a half-minute glaſs; for ſo many knots as run out in that time, ſo many miles the ſhip ſails in an hour. Thus, if there be four knots veered out in half a minute, the ſhip is computed to run four miles an hour.

The author of this device for meaſuring the ſhip's way is not known; and no mention of it occurs till the year 1607, in the Eaſt-India voyage publiſhed by Purchas; but from that time its name occurs in other voyages among his collections; and henceforward it became famous, being taken notice of both by Britiſh authors and by others; as by Gunter in 1623; Snellius in 1624; Metius in 1631; Oughtred in 1633; Herigone in 1634; Saltonſtall in 1636; Norwood in 1637; Pournier in 1643; and almoſt by all the ſucceeding writers of navigation in every country.

To Heave the Log, as they call it, they throw it into the water on the lee-ſide, letting it run till it comes without the eddy of the ſhip's wake; then one holding a half-minute glaſs, turns it up juſt as the firſt knot, or the mark from which the knots begin to be reckoned, turns off the reel (fig. 2.) or paſſes over the ſtern. As ſoon as the glaſs is out, the reel is ſtopped, and the knots run off are told, and their parts eſtimated.

It is uſual to heave the log once every hour in ſhips of war and Eaſt-India men, and in all other veſſels once in two hours; and if at any time of the watch the wind has increaſed or abated in the intervals, ſo as to affect the ſhip's velocity, the officer generally makes a ſuitable allowance for it at the cloſe of the watch.

The log is a very precarious way of computing, and muſt always be corrected by experience and good ſenſe; there being a great deal of uncertainty in the yawing of the ſhip going with the wind aft, or upon the quarter in the heaving of it, by its coming home or being drawn after the ſhip, on account of the friction of the reel and lightneſs of the log in the courſe of the current, and in the ſtrength of the wind, which ſeldom keeps the ſame tenor for two hours together; which is the interval between the times of uſing the log in ſhort voyages, though in longer ones they heave it every hour. Yet this is a much more exact way of computing than any other in uſe; much preferable certainly to that of the Spaniards and Portugueſe who gueſſed at the ſhip's way by the running of the froth or water by the ſhip's ſide; or to that of the Dutch, who uſed to heave a chip-over-board, and to number the paces they walk on the deck while the chip ſwims between any two marks, or bulk-heads on the ſide.

Compound Log. The abovementioned errors, and particularly the log's being ſubject to drive with the motion which the water may have at its ſurface, whereas the experiment requires it to be fixed in the place where it is when the mark commencing the knots goes off the reel, have been conſidered by writers, and many methods have been propoſed to remove, or at leaſt to leſſen them.

The late M. Bonguer propoſed a method, which has been thought deſerving of particular attention, in the Mem. Acad. Sc. 1747; afterwards in his Treatiſe on Navigation publiſhed at Paris in 1753, and ſince reprinted in 1760, by the abbe de la Caille. For this purpoſe, take for the log a conical piece of wood, which fix to the log-line paſſed through or along its axis, at about 40, 50, or 60, or more feet, from one end; and to this end fix the diver, which is a body formed of two equal ſquare pieces of tin, or of thin iron plate, fixed at right angles to one another along their diagonals and its ſize ſo fitted to that of the cone, that the whole may float. A cone of three inches diameter in the baſe, and of ſix inches in the ſlant height, is propoſed by M. Bouguer to ſuit a diver made of plates about 9¾ inches ſquare; the interſection of the diagonals is joined to the log-line, and the loop and peg fixed as in the common log. However, it has been found, that no kind of wood uſed in Britiſh dock-yards, when formed into a cone of the above dimenſions, will float a diver made of ſtout tin plates, one ſide of the ſquare being 1¾inches. Such a diver weighing 1⅞lb. avoirdupoiſe; required to float it a cone of five inches diameter and twelve inches on the ſlant ſide, ſo as the point of the cone, which was made of light fir ſhould juſt appear above the water. Now ſuppoſing one ſide of ſuch a ſquare tin-diver to be about ten inches, and made of plates only two-thirds of the thickneſs of the former, ſuch a diver would weigh, with its ſolder about 20 ounces, and can be floated by a light fir cone of four inches diameter in the baſe, and ten inches in the ſlant height or length; and ſuch a compound log might perhaps be found on trial to be affected by about as much again as that propoſed by M. Bouguer; and conſequently the difference between the numbers given by the common log and compound log, muſt be augmented by two-thirds of itſelf for the neceſſary correction, as below. When the compound log of Bouguer, above deſcribed, is hove overboard, the diver will ſink too deep to be much affected by the current or motion of water at the ſurface, and the log will thereby keep more ſteadily in the place where it firſt fell; and conſequently the knots run off the reel will ſhow more accurately the ſhip's rate of ſailing. As the common log is affected by the whole motion of the current, ſo this compound log will feel only a part thereof, viz. ſuch a part nearly as the reſiſtance of the cone is to the reſiſtance of the diver; then the reſiſtances of the above cone and diver are about as 1 to 5, and conſequently this log will drive but one-fifth part of what the common log would do; and ſo the ſhip's true run will be affected by one-fifth only of the motion of the waters. To obtain the true rate of ſailing, it will be proper to heave alternately, hour and hour, the common log and this compound log; then the difference of their knots run off augmented by its one-fourth part, is the correction; which applied to the knots of the common log, will give the ſhip's true rate of ſailing at the middle time between the hours when theſe logs were hove. The correction is additive when the compound log's run is the greateſt, otherwiſe it is ſubtractive. To find the courſe made good: increaſe the obſerved angle between the log-lines by one fourth part; and this gives the correction to be applied to the apparent courſe, or the oppoſite of that ſhown by the common log; the correction is to be applied to the $\left\{\begin{matrix}\text{right}\\ \text{left.}\end{matrix}\right\}$ of the apparent courſe, when the bearing of the common log is to the $\left\{\begin{matrix}\text{left}\\ \text{right}\end{matrix}\right\}$ of the compound log. Or thus: the lengths run off both logs, together with their bearings, being known; in a card or compaſs apply the knots run off, taken from a ſcale of equal parts along their reſpective bearings, from the centre; join the ends; and in this line produced, on the ſide next the compound log's length, take one-fourth of the interval; then a line drawn from the end, thus produced, to the centre of the card, will ſhow the true courſe and diſtance made good. When a current, ſuch as a tide, runs to any depth, the velocity of that current may be much better aſcertained by the compound log than by the common one, provided the diver does not deſcend lower than the run of the current; for as thoſe ſhips which are deepeſt immerged drive faſteſt with the tide; ſo the diver, by being acted on below, as well as the log on the ſurface, their joint motion will give the total effect of the current's motion better than what could be derived from the motion at the ſurface only. Alſo, by ſuch a compound log, the depth to which any current runs may be eaſily tried.

Other Logs. We have an account in the voyage to the North Pole, p. 97. of two other logs, which were tried by captain Phipps: one invented by Mr Ruſſel, the other by Foxon; both conſtructed upon this principle, that a ſpiral, in proceeding its own length in the direction of its axis through a reſiſting medium makes one revolution round the axis; if, therefore, the revolutions of the ſpiral are regiſtered, the number of times it has gone its own length through the water will be known. In both theſe the motion of the ſpiral in the water is communicated to the clock-work within board by means of a ſmall line faſtened at one end to the ſpiral, which tows it after the ſhip, and at the other to a ſpindle which ſets the clock-work in motion. That invented by mr Ruſſel has a half ſpiral of two threads made of copper, and a ſmall dial with clock-work, to regiſter the number of turns of the ſpiral. The other log has a whole ſpiral of wood with one thread, and a larger piece of clock-work with three dials two of them to mark the diſtance, and the other divided into knots and fathoms, to ſhow the rate by the half-minute glaſs, for the convenience of comparing it with the log. This kind of log will have the advantage of every other in ſmooth water and moderate weather; and it will be uſeful in finding the trim of a ſhip when alone, in ſurveying a coaſt in a ſingle ſhip, or in meaſuring diſtances in a boat between head-lands and ſhoals; but it is ſubject to other inconveniences, which will not render it a proper ſubſtitute for the common log.

Perpetual Log a machine ſo called by its inventor, Mr Gottlieb of Houndſditch, London. It is intended by it to keep a conſtant and regular account of the rate of the ſhip's velocity through the water; whereas the common log hitherto uſed does not indicate the variation in her velocity in the interval of heaving the log, and conſequently does not aſcertain the true diſtance that the ſhip has run in any given length of time.

Plate CCLXXIII.

Fig. 1. is a repreſentation of the whole machine; the lower part of which, EFG, is fixed to the ſide of the keel; H repreſenting only the boundary line of the ſhip's figure. EF are the ſection of a wooden external caſe, left open at the ends KL, to admit the paſſage of the water during the motion of the ſhip. At M is a copper grating, placed to obſtruct the entrance of any dirt, &c. into the machine. I, is ſection of a water-wheel, made from 6 to 12 inches in diameter, as may be neceſſary, with float-boards upon its circumference, like a common water-wheel, that turn by the reſiſtance of the water paſſing through the channel LK. It turns upon a ſhouldered axis, repreſented by the vertical ſection at K. When the ſhip is in motion, the reſiſtance of the water through the channel LK turns round the wheel I. This wheel, by means of a pinion, is connected with and turns the rod contained in the long copper tube N. This rod, by a pinion fixed at its upper extremity, is connected with and turns upon the whole ſyſtem of wheels contained in the dial of the caſe ABCD. This dial, by means of the copper tube N, may be fixed to any convenient place aboard the ſhip. In the front of the dial are ſeveral uſeful circular graduations, as follow: The reference by the dotted line A has an hand which is moved by the wheels within, which points out the motion of the ſhip in fathoms of 6 feet each. The circle at B has an hand ſhowing the knots, at the rate of 48 feet for each knot; and is to be obſerved with the half minute glaſs at any time. The circle C has a ſhort and long hand; the former of which points out the miles in land-meaſure, and the latter or longer the number of knots contained in each mile, viz. 128, which is in the ſame proportion to a mile as 60 minutes to the hour in the reckoning. At *e*, a ſmall portion of a circle is ſeen through the front-plate called the *regiſter*; which ſhows, in the courſe of 24 hours (if the ſhip is upon one tack), the diſtance in miles that ſhe has run; and in the 24 hours the mariner need take but one obſervation, as this regiſter ſerves as an uſeful check upon the fathoms, knots, and miles, ſhown upon the two other circles.

f, Is a plate ſhowing 100 degrees or 6000 miles, and alſo acts as another regiſter or check; and is uſeful in caſe of any miſtake being made in obſerving the diſtance run by the other circles. The reckoning by theſe circles, without fear of miſtake, may therefore be continued to nearly 12,000 miles.

A communication from this machine may eaſily be made to the captain's bed-ſide, where by touching a ſpring only, a bell in the head ABCD will ſound as many times in an half minute as the ſhip ſails miles in an hour.

Mr Gottlieb has applied this machine to the Carteret and Weſtmoreland packets. He is very ſanguine in the hopes of its ſucceſs and utility; and conceives that the mariner will, by this contrivance, be better enabled than heretofore to keep the veſſel and his reckoning together; it being well known that the moſt experienced navigator is too frequently erroneous in this reſpect, the ſhip being ſometimes ahead, or ſometimes aſtern, of the reckoning.

He alſo obſerves, that the conſtruction of the log is ſuch, that if the veſſel was to be aground, ſtrike a rock, or ſtrip off her falſe keel, the parts would not be deranged: and further, ſhould ſhe be laid up for repairs, &c. ſix months, in half an hour after coming again into the water, the lower immerged part of the log would clear itſelf, and be in proper action.

Log-Board, a ſort of table, divided into ſeveral columns, containing the hours of the day and night, the direction of the winds, the courſe of the ſhip, and all the material occurrences that happen during the 24 hours, or from noon to noon; together with the latitude by obſervation. From this table the different officers of the ſhip are furniſhed with materials to compile their journals, wherein they likewiſe inſert whatever may have been omitted, or reject what may appear ſuperfluous in the log-board.

Log-Book, a book into which the contents of the log-board is daily copied at noon, together with every circumſtance deſerving notice that may happen to the ſhip, or within her cognizance, either at ſea or in a harbour, &c. The intermediate diviſions or watches of the log-book, containing four hours each, are uſually ſigned by the commanding officer in ſhips of war or Eaſt Indiamen. See Navigation.

LOGARITHMS.

LOGARITHMS, (from λογος *ratio*, and αριθμος *number*), the indices of the ratios of numbers to one another; being a ſeries of numbers in arithmetical progreſſion, correſponding to others in geometrical progreſſion; by means of which, arithmetical calculations can be made with much more eaſe and expedition than otherwiſe.

Sect. I. *Hiſtory of Logarithms.*

The invention of logarithms firſt occurred to thoſe verſant in the conſtruction of trigonometrical tables, in which immenſe labour was required by large multiplications, diviſions, and extraction of roots. The aim propoſed was, to reduce as much as poſſible the multiplications and diviſions to additions and ſubtractions: and for his purpoſe, a method was invented by Nicholas Raymer Urſus Dithmarſus, which ſerves for one caſe of the ſines, *viz.* when the radius is the firſt term in proportion, and the ſines of two arcs the ſecond and third terms. In this caſe the fourth term is found by only taking half the ſum or difference of the ſines of the other two arcs, and the complement of the greater. This method was firſt publiſhed in 1588, and a few years afterward was greatly improved by Clavius, who uſed it in all proportions in the ſolution of ſpherical triangles; adapting it to ſines, tangents, verſed ſines, and ſecants; and this, whether the radius was the firſt term in the proportion or not.

This method, however, though now become much more generally uſeful than before, was ſtill found attended with trouble in ſome caſes; and as it depended upon certain properties of lines belonging to the circle, was rather of a geometrical than arithmetical nature; on which account the calculators about the end of the 16th and beginning of the 17th century, finding the ſolution of aſtronomical problems extremely troubleſome by reaſon of the tedious multiplications and diviſions they required, continued their endeavours to leſſen that labour, by ſearching for a method of reducing their operations to addition and ſubtraction. The firſt ſtep towards this was, the conſideration, that as in multiplication the ratio of the multiplier to unity is the ſame as that of the product to the multiplicand, it will follow, that the ratio of the product to unity muſt be equal to the ſum of the two ratios of the multiplier to unity, and of the multiplicand to unity. Could a ſet of numbers therefore be found, which would repreſent the ratios of all other numbers to unity, the addition of two of the former ſet of numbers would be equivalent to the multiplication of the two numbers together, the ratios of which they denoted; and the ſum ariſing from this addition would denote the ratio of their product to unity; whence the product itſelf might be found by looking for the correſponding natural number in the table.

The next thing was to fall upon a method of calculating ſuch a table as was wanted, which indeed appeared an Herculean labour. The firſt obſervation was, that whatever numbers might be made uſe of to repreſent the ratios of others, the ratio of equality, or that of unity to unity muſt be 0; for that ratio has properly no magnitude, neither increaſing nor diminiſhing any other ratio to which it is adapted, or from which it is ſubtracted.

2. The ſecond obſervation was, that though any number might be choſen at pleaſure to repreſent the ratio of any other number to unity, yet when once this choice was made, all the other numbers repreſenting the different ratios muſt be determined by it. Thus, if the ratio of 10 to 1 be repreſented by 1, then the ratio of 100 to 1 muſt be 2, and that of 1000 to 1 muſt be 3, &c.; or if 2 was choſen to repreſent the ratio of 10 to 1, then that of 100 to 1 muſt be 4, that of 1000 to 1 muſt be 6, &c.; and no other numbers could poſſibly be uſed.

3. As thoſe artificial numbers repreſented, or were proportional to, the ratios of the natural numbers to unity, they muſt be expreſſions of the numbers of ſome ſmaller equal ratios contained in the former and larger ones. Thus, if we make 1 the repreſentative of the ratio of 10 to 1; then 3, which repreſents the ratio of 1000 to 1, will likewiſe expreſs the number of ratios of 10 to 1, which are contained in that of 1000 to 1. If inſtead of 1, we make 1000 to be the ratio of 10 to 1; then 3000 will expreſs the ratio of 1000 to 1, and this number 3000 will expreſs the number of ſmall ratios of the 1000th root of 10 to 1 contained in the ratio of 1000 to 1; and ſo on for any larger number, as 10,000 100,000, or 10,000,000, &c. Thus, if inſtead of 100 we make 10,000,000 the repreſentative of the ratio of 10 to 1, then the unit will repreſent a very ſmall ratio, of which there are 10,000,000 contained betwixt 1 and 10, and which ratio could not really be had without extracting a root which involved in itſelf, 10,000,000 of times would only make up 10; which root may perhaps be moſt intelligibly expreſſed thus, $\sqrt[10,000,000]{10}$. If the ratio of 10 to 1 contained 10,000,000 of theſe roots, it is evident that the ratio of 100 to 1 muſt contain 20,000,000, that of 1000 would have 30,000,000, &c.; of conſequence the ratio of 100 to 1 will be expreſſed by 20,000,000, of 1000 to 1 by 30,000,000, &c.—Hence, as theſe artificial numbers repreſent the ratios of natural numbers to unity, or are proportional to them, they are very properly called the *logarithms* of theſe numbers, or the *numbers* of their *ratios*; becauſe they really do expreſs this number of ratios.

The relation of logarithms to natural numbers may perhaps more intelligibly be explained by two ſeries of numbers, one in an arithmetical, and the other in geometrical, progreſſion. Thus,

Logarithms,	0	1	2	3	4	5	6	7	8
Nat. numb.	1	2	4	8	16	32	64	128	256

Or,

Logarithms,	0	1	2	3	4	5	6
Nat. numb.	1	10	100	1000	10,000	100,000	1,000,000

In either of theſe ſeries it is evident, that by adding any two terms of the upper line together, a number will be had which indicates that produced by multiplying the correſponding terms of the lower line. Thus, in the firſt two ſeries, ſuppoſe we wiſh to know the product of 4×32. In the upper line we find 2 ſtanding over the number 4, and 5 over 32; adding therefore 5 to 2 we find 7, the ſum of this addition, ſtanding over 128, the product of the two numbers. In like manner, if we wiſh to divide 256 by 8, from the number which ſtands over 256, viz. 8, ſubtract that which ſtands over 8, viz. 3; the remainder 5, which ſtands over 32, ſhows that the latter is the quotient of 256 divided by 8. Let it be required to involve 4 as high as the biquadrate or 4th power: Multiply 2, the number which ſtands over 4, by the index of the power to which the number is to be involved; which index is 4: the product 8, ſtanding over 256, ſhows that this laſt number is the biquadrate of 4 required. Laſtly, let it be required to extract the cube root of 64; divide the number 6, which ſtands over 64, by 3, the index of the root you wiſh to extract; the quotient 2, ſtanding over 4, ſhows that 4 is the root ſought.

Theſe examples are ſufficient to ſhow the great utility of logarithms in the moſt tedious and difficult parts of arithmetic. But though it is thus eaſy to frame a table of logarithms for any ſeries of numbers going on in geometrical progreſſion, yet it muſt be far more difficult to frame a general table in which the logarithms of every poſſible ſeries of geometricals ſhall correſpond with each other. Thus, though in the above ſeries we can eaſily find the logarithm of 4, 8, &c. we cannot find that of 3, 6, 9, &c.; and if we aſſume any random numbers for them, they will not correſpond with thoſe which have already been aſſumed for 4, 8, 16, &c. In the conſtruction of every table, however, it was evident, that the arithmetical or logarithmic ſeries ought to begin with 0; for if it began with unity, then the ſum of the logarithms of any two numbers muſt be diminiſhed by unity before we could find the logarithm of the product. Thus,

Logar.	1	2	3	4	5	6	7	8	9
Nat. N.	1	2	4	8	16	32	64	128	256

Here

Plate CCLXXIII

Log

Fig. 1

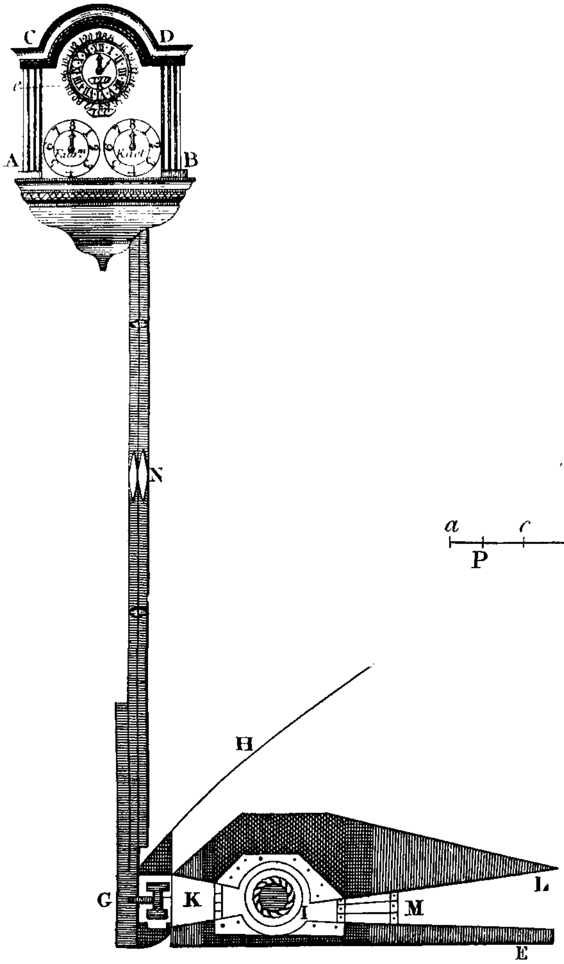


Fig. 2

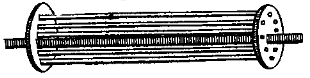


Fig. 3

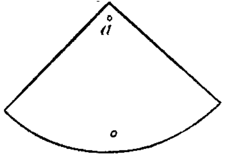
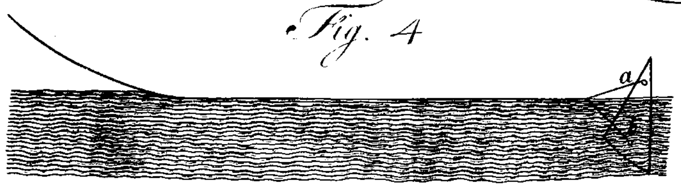


Fig. 4



Logarithms

Fig. 1

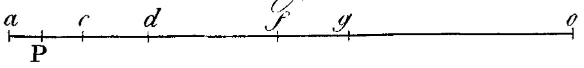


Fig. 2

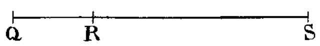


Fig. 3

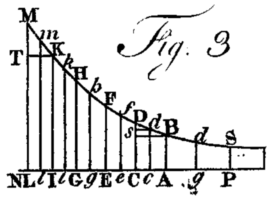


Fig. 4

Fig. 5

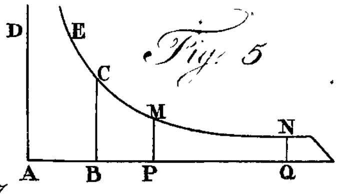


Fig. 6

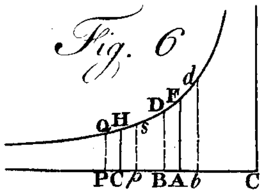


Fig. 7

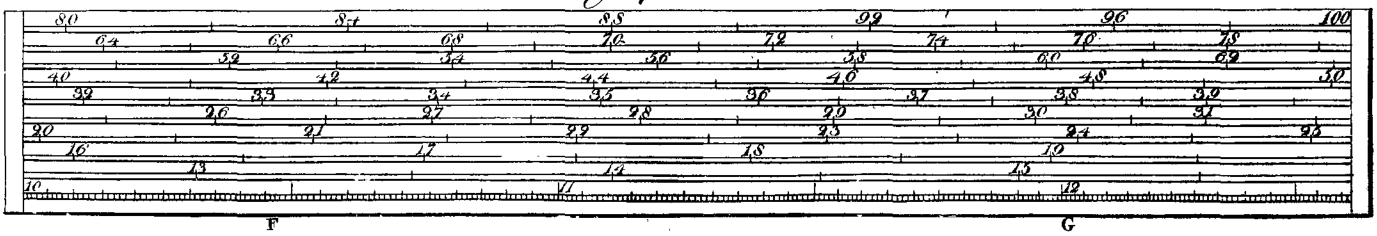


Fig. 8

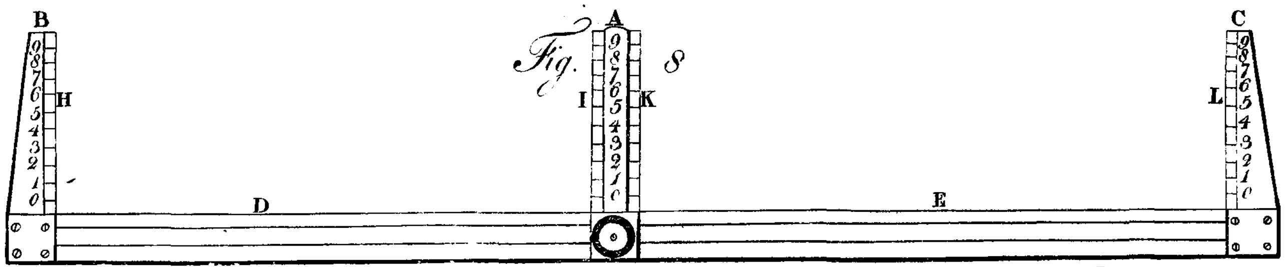


Fig. 9

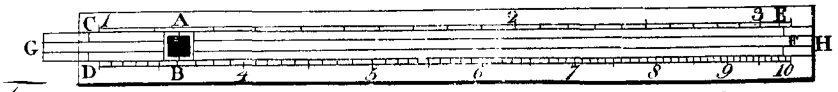


Fig. 10

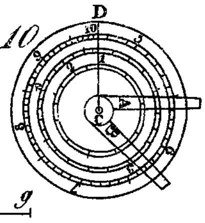


Fig. 11

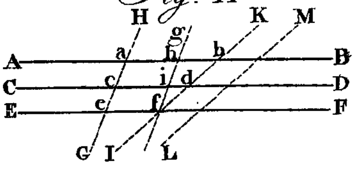
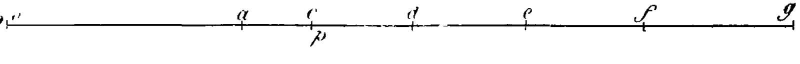


Fig. 12



S. Allardice sc.

Here let it be required to multiply 4 by 16; the number 3 ſtanding over 4, added to 5, which ſtands over 16, gives 8, which ſtands over 128: but this is not juſt; ſo that we muſt diminiſh the logarithm by 1, and then the number 7 ſtanding over 64 ſhows the true product. In like manner it appears, that as we deſcend below unity in a logarithmic table, the logarithms themſelves muſt begin in a negative ſeries with reſpect to the former; and thus the logarithm of 0 will always be infinite; negative, if the logarithms increaſe with the natural numbers; but poſitive, if they decreaſe. For as the geometrical ſeries muſt diminiſh by infinite diviſions by the common ratio, the arithmetical one muſt decreaſe by infinite ſubtractions, or increaſe by infinite additions of the common difference.

This property of numbers was not unknown to the ancient mathematicians. It is mentioned in the works of Euclid; and Archimedes made great uſe of it in his *Arenarius*, or treatiſe on the number of the ſands: and it is probable that logarithms would have been much ſooner invented, had the real neceſſity for them been ſooner felt; but this did not take place till the end of the 16th century, when the conſtruction of trigonometrical tables, and ſolution of perplexed aſtronomical problems, rendered them abſolutely indiſpenſable.

About this time it is probable that many people wiſhed to ſee ſuch tables of numbers, and were making attempts to conſtruct them; but the invention is certainly due to Lord John, Baron of Merchiſton in Scotland. The invention is by ſome indeed aſcribed to Longomontanus; but with very little probability, as he never publiſhed any thing of the kind, nor laid claim to the invention, though he lived to ſee the publication of Baron Napier's tables. Concerning this invention we are told, that "one Dr Craig a Scotchman, coming out of Denmark into his own country, called upon Baron Napier, and told him of an invention of Longomontanus in Denmark, to ſave the trouble of the tedious multiplication and diviſion in aſtronomical calculations; but could give no farther account of it than that it was by proportionable numbers. From this ſlight hint the baron immediately ſet about the work; and by the time that Dr Craig returned to call upon him, he had prepared a rude draught of it, which he called *Canon mirabilis Logarithmorum*; and this draught, with ſame alterations, was printed in 1614.

According to Kepler, one Juſte Byrge, aſſiſtant aſtronomer to the landgrave of Heſſe, either invented or projected logarithms long before Baron Napier, and compoſed a table of ſines for every two ſeconds of the quadrant; though, by reaſon of his natural reſervedneſs, he never publiſhed any thing to the world. But whatever might have been in this, it is certain that the world is indebted for logarithms to Baron Napier, who died in the year 1618. This nobleman likewiſe made conſiderable improvements in trigonometry, and the frequent numerical computations he had occaſion for in this branch, undoubtedly contributed to his invention of the logarithms, that he might ſave part of the trouble in theſe calculations. His book publiſhed in 1614 was intitled *Mirifici Logarithmorum Canonis deſcriptio*. At this time he did not publiſh his method of conſtructing the numbers until the ſenſe of the learned ſhould be known. In other reſpects the work is complete, containing all the logarithms of the natural numbers to the uſual extent of logarithmic tables; with the logarithmic ſines, tangents, and ſecants, for every minute of the quadrant, directions for uſing the tables, &c.

This work was publiſhed in Latin; but was afterwards tranſlated into Engliſh by Mr Edward Wright, inventor of the principles of what has been falſely called *Mercator's Sailing*. The tranſlation was ſent to the Baron, at Edinburgh, and returned with his approbation and ſome few additions. It was publiſhed in 1616, after Mr Wright's death, with a dedication to the Eaſt India Company, by his ſon Samuel Wright, and a preface by Mr Briggs, who afterwards diſtinguiſhed himſelf ſo much in bringing logarithms to perfection. In this tranſlation Mr Briggs alſo gave the deſcription and draught of a ſcale invented by Mr Wright, as well as other methods invented by himſelf, for finding the intermediate proportional numbers; the logarithms already found having been only printed for ſuch numbers as were the natural ſines of each minute.

Mr Wright's tranſlation was reprinted in 1618, with a new title-page, and the addition of 16 pages of new matter, "ſhowing the method of calculating triangles, as well as a method of finding out ſuch lines and logarithms as are not to be found in the canons."

Next year John Speidell publiſhed his New Logarithms, in which were ſome remedies for the inconveniencies attending Baron Napier's method. The ſame year alſo Robert Napier, the Baron's ſon, publiſhed a new edition of his father's book, intitled *Canonis Logarithmorum Deſcriptio*; with another concerning the method of conſtructing them, which the Baron had promiſed; together with ſome other miſcellaneous pieces, which his father had likewiſe compoſed along with Mr Briggs. In 1620 alſo, a copy of theſe works was printed at Lyons in one volume, by Bartholomew Vincent a bookſeller there; but this publication ſeems to have been but little known, as Wingate, who carried logarithms to France four years after, is ſaid to have been the firſt who introduced them into that country.

The *Curſus Mathematicus* publiſhed at Cologne in 1618 or 1619 by Benjamin Urſinus, mathematician to the elector of Brandenburg, contains a copy of Napier's logarithms, together with ſome tables of proportional parts. In 1624 he publiſhed his *Trigonometria*, with a table of natural ſines and their logarithms, according to Baron Napiers method, to every ten ſeconds in the quadrant. The ſame year a book on logarithms was publiſhed at Marpurg by the celebrated Kepler, of the ſame kind with thoſe of Napier. Both of theſe begin as 90° or the end of the quadrant; and, while the ſines decreaſe, the logarithms gradually increaſe; till at the beginning of the quadrant, or 0, the logarithm is infinite. The only difference betwixt the logarithms of Napier and Kepler is, that in the former the arc is divided into equal parts, differing by one minute each; and conſequently their ſines to which the logarithms are adapted are interminate numbers repreſented only by approximating decimals: but in Kepler's table, the radius is divided into equal parts; which are conſidered as perfect and terminate ſines, having equal differences, and to which the logarithms are here adapted. A treatiſe of ſome extent was prefixed to the work; in which the conſtruction and uſe of logarithms is pretty largely treated of. In the year 1627 the ſame author introduced logarithms into his Rudolphine Tables, together with ſeveral others, *viz.* 1. A table ſimilar to that already mentioned; only that the column of ſines or abſolute numbers is omitted, and another added in its ſtead, ſhowing what part of the quadrant each arc is equal to; *viz.* the quotient ariſing from the diviſion of the whole quadrant by each given arc, and expreſſed in integers and ſexageſimal parts. 2. Napier's table of logarithmic ſines to every minute of the quadrant; as alſo two other ſmaller tables adapted for the calculation of eclipſes and the latitude of planets. In this work Juſtus Byrgius is mentioned as having invented logarithms before Napier.

The kind of logarithms now in uſe were invented by Mr Henry Briggs profeſſor of geometry in Greſham college, London, at the time they were firſt diſcovered by Napier. As ſoon as the logarithms of Napier were publiſhed, Mr Briggs directed his attention to the ſtudy and improvement of them; and his employment in this way was announced in a letter to Mr Uſher, afterwards the celebrated archbiſhop, in the year 1615. By him the ſcale was changed, and 0 was made the logarithm of 1; but baron Napier informed Mr Briggs that he had already thought of ſuch a ſcheme, but choſe rather to publiſh the logarithmic tables he had completed, and to let thoſe alone until he ſhould have more leiſure as well as better health. At an interview between baron Napier and Mr Briggs, the preſent plan ſeems to have been ſettled; and in conſequence of the Baron's advice, Mr Briggs made ſome alteration in the method of conſtructing his tables from that which he had begun. A correſpondence alſo took place betwixt the Baron and Mr Briggs, which continued during the lifetime of the former. It appears, however, that, whether Mr Briggs thought of this alteration before baron Napier or not, he certainly was the perſon who firſt publiſhed it to the world; and ſome reflections have been thrown upon the Baron for not making any mention of the ſhare which Mr Briggs had in it.

In 1617 Mr Briggs publiſhed his firſt thouſand logarithms under the title of *Logarithmorum Chilias Prima*, and in 1620 Mr Edward Gunter publiſhed his Canon of Triangles, containing the artificial or logarithmic ſines and tangents for every minute, to ſeven places of figures beſides the index; the logarithm of the radius being 10 000, &c. Theſe were the firſt tables of logarithmic ſines, tangents, &c. which made their appearance upon the preſent plan; and in 1623 they were reprinted in his book *De Sectore et Radio*, along with the *Chilias Prima* of Mr Briggs. The ſame year Mr Gunter applied theſe logarithms of numbers, ſines, and tangents, to ſtraight lines drawn on a ruler; and with theſe the proportions in common numbers as well as in trigonometry, were ſolved by the mere application of a pair of compaſſes: a method founded upon this property, that the logarithms of the terms of equal ratios are equally different. The inſtrument is now well known by the name of the two-feet Gunter's Scale. By the ſame methods he alſo greatly improved the ſector. He was alſo the firſt who uſed the word *coſine* for the ſines of the complement of an arc; and he introduced the uſe of arithmetical complements into the logarithmical arithmetic. He is ſaid alſo to have firſt ſuggeſted the idea of the logarithmic curve, ſo called becauſe the ſegments of its axis are the logarithms of the correſponding ordinates.

The logarithmic lines were afterwards drawn in many other ways. Wingate, in 1627, drew them upon two ſeparate rulers ſliding by each other, in order to ſave the uſe of compaſſes in reſolving proportions. In 1627 alſo, they were applied by Mr Oughtred to concentric circles; about 1650, in a ſpiral form, by one Mr Milburne of Yorkſhire; and in 1657, they were applied on the preſent ſliding-rule by Mr Seth Partridge.

The knowledge of logarithms was diffuſed in France by Mr Edmund Wingate, as already related, though not carried originally thither by him. Two ſmall tracts were publiſhed by him in French, and afterwards an edition in Engliſh, all printed in London. In the firſt of theſe he mentions the uſe of Gunter's Ruler; and in the other that of Briggs's Logarithms, with the canon of artificial ſines and tangents. There are likewiſe tables of theſe ſines, tangents, and logarithms, copied from Gunter.

From the time that Mr Briggs firſt began to ſtudy the nature of logarithms, he applied to the conſtruction of tables with ſuch aſſiduity, that by the year 1624 he publiſhed his *Arithmetica Logarithmica*, containing the logarithms of 30,000 natural numbers to 14 places of figures beſides the index; *viz.* from 1 to 20,000, and from 90,000 to 100,000, together with the differences of the logarithms. According to ſome there was another Chiliad, *viz.* from 100,000 to 101,000; but this does not ſeem to be well authenticated. In the preface to this work, he gives an account of the alteration made in the ſcale by baron Napier and himſelf; and earneſtly ſolicits other perſons to undertake the taſk of filling up the intermediate numbers; offering to give inſtructions, and to afford paper ready ruled for the purpoſe. He gives alſo inſtructions at large in the preface for the conſtruction of logarithmic tables. Thus he hoped to get the logarithms of the other 70,000 natural numbers completed; while he himſelf, being now pretty far advanced in years, might be at liberty to apply to the canon of logarithmic ſines, &c, which was as much wanted by mathematicians as the others. His wiſhes were accompliſhed by Adrian Vlacq or Flack of Gouda in Holland, who completed the number from 20 to 90,000; and thus the world was furniſhed with the logarithms of all natural numbers from 1 to 100,000; but thoſe of Vlacq were only done to 10 places of figures. To theſe was added a table of artificial ſines, tangents, and ſecants, to every minute of the quadrant. Beſides the great work already mentioned, Mr Briggs completed a table of logarithmic ſines and tangents for the 100th part of every degree, to 14 places of figures beſides the index; and a table of natural ſines for the ſame parts to 15 places, with the tangents and ſecants to 10 places, and the methods of conſtructing them. He deſigned alſo to have publiſhed a treatiſe concerning the uſes and application of them, but died before this could be accompliſhed. On his death-bed he recommended this work to Henry Gellibrand profeſſor of aſtronomy

aſtronomy in Greſham college, in which office he had ſucceeded Mr Gunter. Mr Brigg's tables abovementioned were printed at Gouda, and publiſhed in 1633; and the ſame year Mr Gellibrand added a preface with the application of logarithms to plane and ſpherical trigonometry, the whole being denominated *Trigonometria Britannica*: and beſides the arcs in degrees and hundredth parts, has another table containing the minutes and ſeconds anſwering to the ſeveral hundredth parts in the firſt column.

The *Trigonometria Artificialis* of Vlacq contains the logarithmic ſines and tangents to 10 places of figures, to which is added Brigg's firſt table of logarithms from 1 to 20,000, beſides the index: The whole preceded by a deſcription of the tables, and the application of them to plane and ſpherical trigonometry, chiefly extracted from Brigg's *Trigonometria Britannica* already mentioned. In 1635, Mr Gellibrand alſo publiſhed a work intitled, *An Inſtitution Trigonometrical*, containing the logarithms of the firſt 10,000 numbers, with the natural ſines, tangents, and ſecants; and the logarithmic ſines and tangents for degrees and minutes, all to ſeven places of figures beſides the index; likewiſe other tables proper for navigation, with the uſes of the whole. Mr Gellibrand died in 1636, in the 40th year of his age.

A number of other people have publiſhed books on logarithms, which we cannot now particularly enumerate. Some of the principal are:

1. A treatiſe concerning Brigg's logarithms of common numbers from 1 to 20,000, to 11 places of figures, with the logarithmic ſines and tangents but only to eight places. By D. Henrion at Paris, 1626.

2. Briggs's logarithms, with their differences to 10 places of figures, beſides the index for all numbers to 100,000; as alſo the logarithmic ſines, tangents, and ſecants, for every minute of the quadrant, with the explanation and uſes in Engliſh. By George Miller, Lond. 1631.

3. *Trigonometria*, by Richard Norwood, 1631; containing Briggs's logarithms from 1 to 10,000, as well as for the ſines, tangents, and ſecants to every minute, both to ſeveral places of figures beſides the index. The author complains very much of the unfair practices of both the former authors.

4. *Directorium Generale Uranometricum*; by Francis Bonaventure Cavalerius. Bologna, 1632. In this are Mr Briggs's tables of logarithmic ſines, tangents, ſecants, and verſed ſines each to eight places of figures for every ſecond of the firſt 5 minutes, for every 5 ſeconds from 5 to 10 minutes, for every 20 ſeconds from 20 to 30 minutes, for every 30 ſeconds from 30 minutes to 1 degree, and for every minute in the reſt of the quadrant. It contains alſo the logarithms of natural numbers from 1 to 10,000, with the firſt table of verſed ſines that ever was publiſhed. The author likewiſe gives the firſt intimation of the method of finding the arcs or ſpherical ſurface contained by various arcs deſcribed on the ſurface of a ſphere.

5. In 1643 appeared the *Trigonometria* of the ſame author, containing the logarithms of the natural numbers from 1 to 1000, with their differences to eight places of figures; likewiſe a table of natural and logarithmic ſines, tangents, and ſecants; the former to ſeven, the latter to eight, places of figures; *viz.* to every 10″ of the firſt 30′, to every 30″ from 30′ to 1°, and the ſame for their complements, or backwards thro' the laſt degree of the quadrant; the intermediate 88° being only to every minute.

6. *Tabulæ Logarithmicæ*; by Mr Nathaniel Rowe, paſtor of Benaire in Suffolk: Lond. 1633. In this work are contained Mr Briggs's logarithms of natural numbers from 1 to 100,000, to eight places of figures; likewiſe the logarithmic ſines and tangents to every 100th part of degrees to ten places.

7. *Clavis Univerſa Trigonometriæ*; Hamburg, 1634: containing tables of Briggs's logarithms from 1 to 2000; and of ſines, tangents, and ſecants, for every minute, both for ſeven places.

8. *Trigonometria Britannica*, by John Newton, London, 1658. In this the logarithmic tables of natural numbers were reduced to their moſt convenient form; the author having availed himſelf of the labours of Wingate and Rowe, uniting their ſeveral methods, and diſpoſing of the whole as in the beſt logarithmic tables uſed at preſent. It contains likewiſe the logarithmic ſines and tangents to eight figures beſides the index; for every hundredth part of a degree, with the differences, and for thouſandth parts in the firſt three degrees. He cenſures the unfair practices of ſome former publiſhers of logarithms; particularly of Vlacq already mentioned.

9. *Matheſis Nova*, by John Caramual, 1670. This contained 1000 logarithms, both of the forms of Napier and Briggs, as well as 1000 of what he calls *perfect logarithms*, viz. thoſe of Briggs's firſt method of conſtruction; which differs from the laſt only in this, that the laſt increaſes, whilſt the firſt decreaſes; the radix or logarithm of the ratio of 10 to 1 being the very ſame in both.

10. Sherwin's Mathematical Tables, publiſhed in 8vo, form the moſt complete collection of any; containing, beſides the logarithms of all numbers to 101,000, the ſines, tangents, ſecants, verſed ſines both natural and logarithmic, to every minute of the quadrant. The firſt edition was printed in 1706; but the third, publiſhed in 1742 and reviſed by Gardiner, is looked upon to be ſuperior to any other. The fifth and laſt edition, publiſhed in 1771, is ſo incorrect, that no dependence can be placed upon it.

11. Tables of logarithms from 1 to 102,100, and for the ſines and tangents to every 10 ſeconds of each degree in the quadrant; as alſo for the ſines of the firſt 72 minutes to every ſingle ſecond, with other uſeful and neceſſary tables. By Gardiner, London, 1742. This work contains a table of logiſtical logarithms, and three ſmaller tables to be uſed for finding the logarithms of numbers to 20 places of figures. Only a ſmall number of theſe tables was printed, and that by ſubſcription; and they are now in the higheſt eſteem for accuracy and uſefulneſs. An edition of theſe tables was printed at Avignon in France in 1770, with the addition of ſines and tangents for every ſingle ſecond in the firſt four degrees, and a ſmall table of hyperbolic logarithms, taken from a treatiſe upon fluxions by the late Mr Thomas Simſon. The tables are to ſeven places of figures, but ſomewhat leſs correct than thoſe publiſhed by Gardiner himſelf.

12. An Antilogarithmic Canon for readily finding the number correſponding to any logarithm, was begun by

the algebriſt Mr Harriot, who died in 1621; and completed by Mr Walter Warner, the editor of Harriot's works, before 1640, but never was publiſhed for want of encouragement to print it. In 1714 a ſmall ſpecimen of ſuch a canon appeared in the Philoſophical Tranſactions for that year by Mr Long of Oxford; and in 1742 a complete Antilogarithmic Canon appeared by Mr James Dodſon, in which the numbers correſponding to each logarithm from 1 to 100,000 are computed to 11 places of figures.

12. In 1783 were publiſhed M. Callet's tables at Paris; which for the elegance of the workmanſhip are much ſuperior to any thing of the kind that ever appeared, though their accuracy is not eſteemed equal to that of ſome others. The work is a neat volume ſmall 8vo. It contains a treatiſe on logarithms, with their uſes and application to various ſciences; as trigonometry, aſtronomy, and navigation; a table of logarithms from 1 to 102,960, with the differences; a table of ſines and tangents for every ſingle ſecond of the firſt two degrees, and for every 10 ſeconds of the reſt of the quadrant; with tables of logiſtical and hyperbolic logarithms, and ſome others for determining the longitude at ſea.

SECT. II. *Different methods of conſtructing Logarithms.*

§. 1. *Napier's method.*

THE logarithms firſt thought of by Baron Napier were not adapted to the natural ſeries of arithmetical numbers 1, 2, 3, &c. becauſe he did not then intend to adapt them to every kind of arithmetical calculation, but only to that particular operation which had called for their immediate conſtruction, viz. the ſhortening of trigonometrical operations: he explained the generation of logarithms, therefore, in a geometrical way. Both logarithms, and the quantities to which they correſpond, in his way, may be ſuppoſed to proceed from the motion of a point; which, if it moves over equal ſpaces in equal times, will produce a line increaſing equally: but if, inſtead of moving over equal ſpaces in equal times, the point deſcribes ſpaces proportional to its diſtances from a certain term, the line produced by it will then increaſe proportionably. Again if the point moves over ſuch ſpaces in equal times, as are always in the ſame conſtant ratio to the lines from which they are ſubducted, or to the diſtance of that point at the beginning of the lines, from a given term in that line, the line ſo produced will decreaſe proportionably. Thus, let *ac* be to *ao*, *cd* to *co*, *ef* to *fo*, and *fg* to *fo*, always in a certain ratio, viz. that of QR to QS, and let us ſuppoſe the point P to ſet out from *a*, deſcribing the diſtances *ac*, *cd*, *de*, &c. in equal ſpaces of time, then will the line *ao* decreaſe proportionably.

Plate CCLXXIII fig. 1, 2.

In like manner, the line *oa*, (fig. 12.) increaſes proportionally, if the point *p*, in equal times, deſcribes the ſpaces *ac*, *cd*, *de*, *fg*, &c. ſo that *ac* is to *ao*, *cd*, to *co*, *de* to *do*, &c. in a conſtant ratio. If we now ſuppoſe a point P deſcribing the line AG (fig. 4.) with an uniform motion, while the point *p* deſcribes a line increaſing or decreaſing proportionally, the line AP, deſcribed by P, with this uniform motion, in the ſame time that *oa*, by increaſing or decreaſing proportionally, becomes equal to *op*, is the logarithm of *op*. Thus AC, AD, AE, &c. are the logarithms of *oc*, *od*, *oe*, &c. reſpectively: and *oa* is the quantity whoſe logarithm is ſuppoſed equal to nothing.

We have here abſtracted from numbers, that the doctrine may be the more general; but it is plain, that if AC, AD, AE, &c be ſuppoſed 1, 2, 3, &c. in arithmetic progreſſion; *oc*, *od*, *oe*, &c. will be in geometric progreſſion; and that the logarithm of *oa*, which may be taken for unity, is nothing.

Baron Napier, in his firſt ſcheme of logarithms, ſuppoſes, that while *op* increaſes or decreaſes proportionally, the uniform motion of the point P, by which the logarithm of *op* is generated, is equal to the velocity of *p* at *a*; that is, at the term of time when the logarithms begin to be generated. Hence logarithms, formed after this model, are called *Napier's Logarithms*, and ſometimes *Natural Logarithms*.

When a ratio is given, the point *p* deſcribes the difference of the terms of the ratio at the ſame time. When a ratio is duplicate of another ratio, the point *p* deſcribes the difference of the terms in a double time. When a ratio is triplicate of another, it deſcribes the difference of the terms in a triple time; and ſo on. Alſo, when a ratio is compounded of two or more ratios, the point *p* deſcribes the difference of the terms of that ratio in a time equal to the ſum of times in which it deſcribes the differences of the terms of the ſimple ratios of which it is compounded. And what is here ſaid of the times of the motion of *p* when *op* increaſes proportionally, is to be applied to the ſpaces deſcribed by P, in thoſe times, with its uniform motion.

Hence the chief properties of logarithms are deduced. They are the meaſures of ratios. The exceſs of the logarithm of the antecedent above the logarithm of the conſequent, meaſures the ratio of thoſe terms. The meaſure of the ratio of a greater quantity to a leſſer is poſitive; as this ratio, compounded with any other ratio, increaſes it. The ratio of equality, compounded with any other ratio, neither increaſes nor diminiſhes it; and its meaſure is nothing. The meaſure of the ratio of a leſſer quantity to a greater is negative; as this ratio, compounded with any other ratio, diminiſhes it. The ratio of any quantity A to unity, compounded with the ratio of unity to A, produces the ratio of A to A, or the ratio of equality; and the meaſures of thoſe two ratios deſtroy each other when added together; ſo that when the one is conſidered as poſitive, the other is to be conſidered as negative. By ſuppoſing the logarithms of quantities greater than *oa* (which is ſuppoſed to repreſent unity) to be poſitive, and the logarithms of quantities leſs than it to be negative, the ſame rules ſerve for the operations by logarithms, whether the quantities be greater or leſs than *ao*. When *op* increaſes proportionally, the motion of *p* is perpetually accelerated; for the ſpaces *ac*, *cd*, *de*, &c. that are deſcribed by it in any equal times that continually ſucceed after each other, perpetually increaſe in the ſame proportion as the lines *oa*, *oc*, *od*, &c. When the point *p* moves from *a* towards *o*, and *op* decreaſes proportionally, the motion of *p* is perpetually retarded; for the ſpaces deſcribed by it in any equal times that continually ſucceed after each other, decreaſe in this caſe in the ſame proportion as *op* decreaſes.

If the velocity of the point *p* be always as the diſtance *op*, then will this line increaſe or decreaſe in the manner ſuppoſed by Baron Napier, and the velocity of the point *p* being the fluxion of the line *op*, will always vary in the ſame ratio as this quantity itſelf. This, we preſume, will give a clear idea of the geneſis or nature of logarithms; but for more of this doctrine, ſee Maclaurin's Fluxions.

The conſtruction of his tables of logarithms was firſt publiſhed in his poſthumous work of 1619. The conſtruction of his canon was chiefly effected by generating, in an eaſy manner, a ſeries of proportional numbers, and their arithmeticals or logarithms; and then finding by proportion the logarithms of the natural ſines from thoſe of the neareſt numbers among the original proportionals. Beginning then at the radius 10,000,000, he firſt conſtructs ſeveral deſcending geometrical ſeries, of ſuch a nature that they are quickly formed by an eaſy addition or ſubtraction, or diviſion by 2, 10, 100, &c. His firſt table conſiſts of proportionals in the ratio of 10,000,000 to 9,999,999; the method of doing which may be eaſily underſtood from the following example: Suppoſe it were required to find a ſeries of deſcending proportionals in the ratio of 100 to 99; it may be done by adding two cyphers to each of the two firſt terms, and continually adding 1 to the decimal place fartheſt to the right hand. Thus the firſt term will be 100.00, the ſecond 99.00, the third 98.01, the fourth 98.03, &c. Napiers firſt table contained 100 terms of a ſeries, as we already mentioned, in the proportion of 10,000,000 to 9,999,999. The firſt term of which ſeries was 10,000,000.0000000; the ſecond 9,999,999.0000000; the third was 9,999,998.0000001, and ſo on till the 100th term, which was 9,999,900.0004950. The ſecond table conſiſted of 50 numbers nearly in the proportion of 100,000 to 99,999, and this was formed by ſubſtituting the units 1, 3, &c. in the third decimal place inſtead of the laſt place towards the right hand. The reaſon of conſtructing this table was, that he might have a ſeries in the proportion of his firſt term of the former to the laſt term of it, *viz.* of 100,000 to 99,999; and the laſt of the ſecond ſeries was 9995001.222927. In all theſe ſeries the method of finding the terms is exactly the ſame. Thus in the firſt example, where we begin with 100, each term decreaſes by the 100th part of the former, and this 100th part is found by removing the number two places of figures lower, and ſubtracting them from the former terms. Thus 99 is leſs than 100 by unity, which is the 100th part of the latter; the next term is leſs than 99 by the 100th part of 99, and is therefore 98.01. But the diviſion by 100 can be performed without any trouble, only ſetting the decimal point two places farther forward, as that by 10 is performed by ſetting it one place farther forward; thus $9 \div 10 = 9$; $99 \div 100 = .99$. Now by ſubtracting 99 from 100, we have 98.01 for the third term of the ſeries. To find the fourth term then, remove the decimal point two figures farther to the right hand and ſubtract it from the former; and we have then 97.0299 for the fourth term of the ſeries. Thus we ſee, that the number of decimal places muſt continually increaſe; but as in this ſeries we want no more than two decimal places inſtead of 97,0299, the term is made 97.03, as the neareſt number which has only two decimal places, and differs from the truth only by one thouſandth part. In like manner, in the long ſtring of ciphers, the fourth term of the ſeries differs ſomewhat, but very little from the truth: and this muſt always be the caſe while the radius is ſuppoſed to conſiſt of any finite number of parts; though, by going on for a very long time in this way, the error, by being continually repeated and augmented at every term, would at laſt become perceptible: and therefore none of theſe ſeries are carried on to a very great length.

His next ſtep was to conſtruct a third table conſiſting of 69 columns, and each column of 21 numbers or terms in the continual proportion of 10000 to 9995; that is, nearly as the firſt term of the ſecond table is to its laſt term. As this proportion is the 2000th of the whole, the method of finding the terms will be by dividing each upper number by 2, and removing the figures of the quotient three places lower, and then ſubtracting them. In this way, however, it is proper to collect only the firſt column of 21 numbers, the laſt of which will be 9900473.5780: but the firſt, ſecond, and third, &c. numbers in all the other columns are in the continual proportion of 100 to 99, or nearly of the firſt to the laſt in the firſt column; whence theſe are to be found by removing the figures two places lower, and then ſubtracting them, as has already been explained.

By theſe three tables, the Baron was furniſhed with about 1600 proportionals, nearly coinciding with all the natural ſeries from 90 to 30 degrees. To obtain the logarithms of thoſe proportionals, he demonſtrated and applied ſome of the properties and relations of the numbers and logarithms; the principal of which are, 1. That the logarithm of any ſine is greater than the difference between that ſine and the radius, but leſs than that difference when increaſed in the proportion of the ſine to the radius. 2. That the difference between the logarithms of two ſines is leſs than the difference of the ſines increaſed in the proportion of the leſſer ſine to the radius, but greater than the difference of the ſines increaſed in the proportion of the greater ſine to the radius. Theſe properties now ſerved him as theorems for finding the logarithms themſelves in an eaſy manner. From the firſt of them it appeared, that the radius being 10,000,000, the firſt term of the table, the logarithm of 9,999,999, the ſecond term, muſt be greater than the difference betwixt that term and the radius, which is 1, but leſs than the difference when increaſed in the proportion of the ſine to the radius; but this proportion is only one ten millionth part, for $9,999,999 \times 1.0000001 = 10,000,000$; whence the logarithm of the radius or 10,000,000 being 0, the logarithm of 9,999,999, the ſecond term will be between 1 and 1.0000001, or very nearly 1.0000005, this being the arithmetical mean betwixt 1 and 1.0000001. This will alſo be the common difference betwixt every two ſucceeding terms in the firſt table; becauſe all the terms there are in the ſame proportion of 10,000,000 to 9,999,999. Hence by the continual addition of this logarithm we have the logarithms of the whole ſeries, and therefore that of the laſt term of the ſeries, *viz.* 9999900.0004950 will be 100.00005.

The ſecond table, as we have already ſaid, conſiſts of

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of a ſeries of numbers in the continual proportion of 100000 to 99999 whence the firſt term being 10,000,000 the ſecond will be 9,999,900; the difference betwixt this and the laſt term of the former ſeries is .0004950. But by the ſecond theorem, the difference between the logarithms of 9,999,900 0004950 and 9,999,900, the ſecond term of the ſecond table, will be leſs than .0004950, increaſed in the proportion 99999 to 100000, but greater than .0004950, increaſed in the proportion of 9,999,900.0004950; that is to ſay, if we augment .0004950 by one hundred thouſandth part, it will be greater than the difference betwixt the logarithms of the two terms. The limits, therefore, are here ſo extremely ſmall, that we may account the difference betwixt the two terms and that of the logarithms themſelves the ſame: adding therefore this difference.0004950 to 100.000005, we have 100.0005000 for the logarithm of the ſecond term, and likewiſe for the common difference of all the logarithms of the terms of the ſecond table. Again, by the ſame theorem, the difference between the logarithms of this laſt proportional of the ſecond table and the ſecond term in the firſt column of the third table, will be found to be 1.2235287; which added to the laſt logarithm, gives 5001.2485387 for the logarithm of 9,995,000, the ſecond term of the third table: and in a ſimilar manner, by the ſame theorem, he finds the logarithms of all the other terms of the reſt of the columns.

Thus our author completed what he calls his radical table, from which he found his logarithmic ſines by taking, according to the ſecond theorem, the ſum and difference of each tabular ſine, and the neareſt number in the radical table. Annex then ſeven ciphers to the difference; divide the number by the ſum, and half the quotient will be the difference between the logarithms of the tabular ſine and radical number; and conſequently, by adding or ſubtracting this difference to or from the logarithm of the natural number, we have the logarithmic ſine required.

In this manner were completed the logarithmic ſines from radius or ſine of 90° to the half of it, or ſine of 30°. To complete the other 30°, he obſerves, that the logarithm of the ratio of 2 to 1, or of one half the radius, is 6931469.22; that of the ratio of 4 to 1 is double of it; that of 8 to 1, triple of it, &c.; and thus going on to compute the logarithms of the ratio between 1 and 40, 80, 100, &c. to 10,000,000: then multiplying any given ſine for an arc leſs than 30° by ſome of theſe numbers, he finds the product nearly equal to ſome number in the table; and then finds the logarithm by the ſecond theorem as already directed.

Another, and much eaſier method, however, of performing the ſame thing is founded upon the following proportion, which he demonſtrates, *viz.* that as half the radius is to the ſine of half an arc, ſo is the coſine of the half arc to the ſine of the whole arc; or as one half the radius is to the ſine of any arc, ſo is the coſine of that arc to the ſine of double the arc. Hence the logarithmic ſine of an arc is found by adding the logarithms of half the radius and the ſine of double the arc, and then ſubtracting the logarithmic coſine from the ſum. In this way, he obſerves that the ſines for full one half of the quadrant may be found, and the remainder by one eaſy diviſion, or addition and ſubtraction for each, as already directed.

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§. 2. *Kepler's Method of Conſtruction.*

This was founded on principles nearly ſimilar to that of Napier. He firſt of all erects a ſyſtem of proportions, and the meaſures of proportion, founded upon principles purely mathematical; after which he applies theſe principles to the conſtruction of his table, containing only the logarithms of 1000 numbers. The propoſitions on which his method is founded are in ſubſtance the following.

1. All equal proportions equal among themſelves are expreſſed by the ſame quantity, be the terms many or few; as the proportion of 2, 4, 8, &c. in geometrical progreſſion is expreſſed by 2; and of 2, 6, 18, 54, &c. by 3.

2. Hence the proportion of the extremes is compoſed of all the proportions of the intermediate terms; thus the proportion of 2 to 8 is compounded of that of 2 to 4, and of 4 to 8.

3. The mean proportional betwixt two terms divides that proportion into two equal ones. Thus the proportion between 2 and 32 is divided by the mean proportional 8 into two equal proportions of 4; for 2 is to 8, as 8 is to 32.

4. In any number of proportionals regularly increaſing, the means divide the proportion of the extremes into one more than their own number. Thus, in the ſeries 2, 4, 8, 16, the proportion of the extremes 2 and 16 is by the *two* means 4 and 8, divided into *three* proportions, *viz.* that betwixt 2 and 4, 4 and 8, 8 and 16. In like manner, in the ſeries 3, 6, 18, 54, 162, 486, the proportion betwixt 3 and 486 is divided by the four means into the five proportions of 3 to 6; 6 to 18; 18 to 54; 54 to 162; and 162 to 486.

5. The proportion betwixt any two terms is diviſible into any number of parts, until theſe become leſs than any aſſignable quantity. Thus the proportion of 2 to 8 is diviſible, by multiplying the two together and extracting the ſquare root, into two parts by the number 4: by multiplying two and 4 together, and extracting the ſquare root; and doing the ſame with 4 and 8, the proportion would be divided into four parts, *viz.* $2.\sqrt{8}.4.\sqrt{32}.8$; or in numbers, 2 : 2.813, &c. : 4 : 5.655, &c. : 8.

6. By dividing the ratios in this manner, the elementary part will become at laſt ſo ſmall, that it may be denominated by the mere difference of terms of that element. This is evident from the diminution of the ratios or proportions already inſtanced: for the proportion between 2 and 2.813 is only 1.406, &c. and if we were to find a mean proportional betwixt 2 and 2.813, the ratio betwixt that proportional and 2 would be much leſs. But it muſt always be remembered, that ſuch *evaneſcent* quantities, as they are called, cannot give us any concluſion with abſolute exactneſs, however they may anſwer every uſeful purpoſe to us: for it is evident that neither mean proportional nor ratio can ever be found exactly; and therefore the error accumulated in all the operations muſt become very conſiderable, if any circumſtance ſhall happen to make it appear.

7. In three continued proportionals, the difference of

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of the two firſt has to the difference between the two laſt the ſame proportion that the firſt term has to the ſecond, or the ſecond to the third. Thus, in the three terms 4, 8, 16, the difference between the two firſt terms 4 and 8, viz. 4, is in proportion to 8; and the difference between the two laſt, as 4 is to 8, or 8 to 16.

8. In continued proportionals, the greateſt terms have the greateſt differences, and *vice verſa*. Thus, the difference between 8 and 16 is evidently greater than between 2 and 4 or 4 and 8.

9. If the difference betwixt the two greateſt terms be made the meaſure of the proportion between them, the difference between any two others will be leſs than the true meaſure of their proportion. Thus in the ſeries, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, &c. where the difference 2 betwixt the two greateſt terms expreſſes their true proportion, it is plain, that the difference 1 betwixt 2 and 1 is leſs than their ratio, as well as between $\frac{1}{3}$ or $\frac{1}{4}$, &c.

10. In any ſeries of proportionals, if the difference betwixt the greateſt term and one not immediately next to it, be taken as the meaſure of the propoportion, then the proportion betwixt the greateſt term and any other greater than the term before taken, will be leſs than the difference of thoſe terms; but the proportion which is between the greateſt term and any one leſs than that firſt taken, will be greater than their difference. As proportionals of this kind do not readily occur, we ſhall, in order to avoid obſcurity, ſhow once for all, that there is a poſſibility of finding geometrical proportionals of ſuch a nature, that the ratio may be equal to the difference betwixt the greateſt and third, or any other term diſtant from it. Thus let us begin with any two numbers we pleaſe, ſuppoſe 9 and 10; though theſe are in the natural arithmetical proportion, yet if we make the ratio 1.111, they will alſo be geometrically proportional, and the ſeries will run thus:

1ſt 2d 3d 4th 5th 6th
term term term term term term
10 : 9 : 8.099 : 7.289 : 6.560 : 59.04, &c.

Here the difference betwixt the firſt and third terms is 1.901, which is greater than the ratio; that betwixt the ſecond and fourth, viz. 1.711, is ſtill greater, but nearer to it than the former; the difference between the third and fifth terms, viz. 1.539, ſtill approximates, as does that between the fourth and ſixth, viz. 1.385: and indeed by continuing this ſeries only for two terms longer, the difference will become ſmaller than the ratio. It is not worth while, however, to ſeek for ſerieſes of this kind, as the preſent propoſition will now be ſufficiently intelligible without any farther illuſtration.

11. If quantities be arranged according to the order of their magnitudes, and if any two ſucceſſive proportions of theſe be equal, the three ſucceſſive terms which conſtitute them will alſo be equal. Thus, if the two quantities 12 and 8 conſtitute the proportion $\frac{12}{8}$, and each of them be leſſened by 6, the half of 12, we have the proportion $\frac{6}{2}$; which is more than double the original proportion; for $\frac{6}{2}=3$, and $\frac{12}{8} \times \frac{12}{8}, = \frac{9}{4} = 2\frac{1}{4}$.

12. When quantities are placed in the order of their magnitudes, if the intermediate magnitudes lying between any two terms be not among the mean proportionals which can interpoſe betwixt theſe two terms, then theſe intermediates will not divide the proportion of thoſe two terms into commenſurable proportions. Thus in the magnitudes 343 : 216 : 125 : 64 : 27 : 8, neither of the two intermediate terms 125 and 64 are mean proportionals betwixt 27 and 216, nor do they divide the proportion betwixt theſe into commenſurable parts.

13. All the proportions taken in order, which are between expreſſible terms that are in arithmetical proportion, are incommenſurable to one another; as between 8, 13, and 18.

14. When quantities are placed in the order of their magnitude, if the difference between the two greateſt be made the meaſure of their proportion, the difference between any two others will be leſs than the meaſure of *their* proportion, and if the difference between the two leaſt terms be made the meaſure of their proportion, the differences of the reſt will be greater than the meaſure of the proportion between their terms.

15. If the meaſure of proportion between the greateſt exceed their difference, then the proportion of this meaſure to the difference will be leſs than that of a following meaſure to the difference in its terms; becauſe proportionals have the ſome ratio.

16. If three equidifferent quantities are taken in order, the proportion between the extremes is more than double that betwixt the two greater terms. Hence it follows, that half the proportion of the extremes is greater than the proportion between the greateſt terms, but leſs than the proportion of the two leaſt.

17. If two quantities conſtitute a proportion, and each be leſſened by half the greater, the remainder will conſtitute a proportion more than double the former.

18. If 1000 numbers follow one another in the natural order, 1000, 999, 998, &c. and by continual multiplication and extraction of the ſquare root we find mean proportionals, and thus *biſect*, as it is called, the ratio between the two greateſt, ſo that the parts into which the ratio is divided become ultimately ſmaller than the exceſs of proportion betwixt the next two over the former (for 998 bears a greater proportion to 999 than 999 bears to 1000); the meaſure of this very ſmall part or element of the proportion may be ſuppoſed to be the difference between 1000 and that mean proportional which is the other term of the element. Thus, for the ſake of an eaſy explanation, let us ſuppoſe the numbers to be 10, 9, 8, &c. the ratio of 9 to 10 is 1.11, that of 9 to 8 is 1.125, the difference between which is .014, which we may call the elementary part of the ratios. By ſix extractions of the ſquare root we have the mean proportional 9.985, &c. differing from 10 by no more than .015, which is very near the element juſt mentioned. The number of parts into which the ratio is thus divided is expreſſed by the 6th power of 2 to 64. Dividing therefore the ratio between 9 and 10 or 1.11 by 64, we have .017 for the elementary part thus obtained; which near coincidence with the real element, and the difference between 10 and the mean proportional itſelf, ſhows that in large numbers we may take the difference between the mean proportional and greateſt term for the elementary power without any ſenſible error.

Suppoſe now, that the proportion between 1000 and

and 998 be divided into twice the number of parts that the former was, it will be equally plain that the difference betwixt 1000 and the next mean proportional will be the meaſure of that element. Proceeding in like manner with the other numbers 1000 and 997, 1000 and 996, &c. it is evident, that by dividing into a proper number of parts, all the elements will be reduced to an equal degree of *fineneſs*, if we may ſo call it, and in calculations may be made uſe of without any fear of error.

19. The number of elementary parts being thus known which are contained in any proportion, it will be eaſy to find the ratios between thoſe numbers which are in continued proportion to the firſt term of the ſeries. Thus, having found the proportion between 1000 and 900.

we know alſo that of 1000 to 810, and 729 ;
And from 1000 to 800, alſo 1000 to 640, and to 512 ;
And from 1000 to 700, alſo 1000 to 490, and to 343 ;
And from 1000 to 600, alſo 1000 to 360, and to 216 ;
And from 1000 to 500, alſo 1000 to 250, and to 125.

Corol. Hence ariſes the precept for ſquaring, cubing, &c. ; as alſo for extracting the ſquare root, cube root, &c. out of the firſt figures of numbers. For it will be, As the greateſt number of the chiliad as a denominator, is to the number propoſed as a numerator, ſo is this to the ſquare of the fraction, and ſo is this to the cube.

20. *Prop.* The proportion of a number to the firſt, or 1000, being known ; if there be two other numbers in the ſame proportion to each other, then the proportion of one of theſe to 1000 being known, there will alſo be known the proportion of the other to the ſame 1000.

Corol. 1. Hence from the 15 proportions mentioned in prop. 18. will be known 120 others below 1000, to the ſame 1000.

For ſo many are the proportions, equal to ſome one or other of the ſaid 15, that are among the other integer numbers which are leſs than 1000.

Corol. 2. Hence ariſes the method of treating the Rule of Three, when 1000 is one of the given terms.

For this is effected by adding to, or ſubtracting from, each other, the meaſures of the two proportions of 1000 to each of the other two given numbers, according as 1000 is, or is not, the firſt term in the Rule of Three.

21. *Prop.* When four numbers are proportional, the firſt to the ſecond as the third to the fourth, and the proportions of 1000 to each of the three former are known, there will alſo be known the proportion of 1000 to the fourth number.

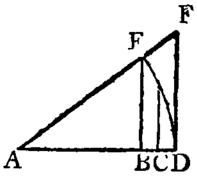
Corol. 1. By this means other chiliads are added to the former.

Corol. 2. Hence ariſes the method of performing the Rule of Three, when 1000 is not one of the terms. Namely, from the ſum of the meaſures of the proportions of 1000 to the ſecond and third, take that of 1000 to the firſt, and the remainder is the meaſure of the proportion of 1000 to the fourth term.

Definition. The meaſure of the proportion between 1000 and any leſs number, as before deſcribed, and expreſſed by a number, is ſet oppoſite to that leſs number in the chiliad, and is called its *logarithm*, that is, the number (αριθμος) indicating the proportion (λογον) which 1000 bears to that number, to which the logarithm is annexed.

22. *Prop.* If the firſt or greateſt number be made the radius of a circle, or *ſinus totus*; every leſs number conſidered as the coſine of ſome arc, has a logarithm greater than the verſed ſine of that arc, but leſs than the difference between the radius and ſecant of the arc ; except only in the term next after the radius, or greateſt term, the logarithm of which by the hypotheſis is made equal to the verſed ſine.

That is, if CD be made the logarithm of AC, or the meaſure of the proportion of AC to AD; then the meaſure of the proportion of AB to AD, that is, the logarithm of AB, will be greater than BD, but leſs than EF. And this is the ſame as Napier's firſt rule in page 44.



23. *Prop.* The ſame things being ſuppoſed ; the ſum of the verſed ſine and exceſs of the ſecant over the radius, is greater than double the logarithm of the coſine of an arc.

Corol. The logarithm coſine is leſs than the arithmetic mean between the verſed ſine and the exceſs of the ſecant.

Precept 1. Any ſine being found in the canon of ſines, and its defect below radius to the exceſs of the ſecant above radius ; then ſhall the logarithm of the ſine be leſs than half that ſum, but greater than the ſaid defect or coverſed ſine.

Let there be the ſine	99970.1490	of an arc ;
Its defect below radius is	29.8510	the covers. and leſs than logarithm ſine ;
Add the exceſs of the ſecant	29.8599	
Sum	59.7109	
Its half or	29.8555	greater than the logarithm.

Therefore the logarithm is between $\left\{\begin{array}{l}29.8510 \text{ and} \\ 29.8555.\end{array}\right.$

Precept 3. The logarithm of the ſine being found, you will alſo find nearly the logarithm of the round or integer number which is next leſs than your ſine with a fraction, by adding that fractional exceſs to the logarithm of the ſaid ſine.

Thus the logarithm of the ſine 99970.149 is found to be about 29.854 ; if now the logarithm of the round number 99970,000 be required, add 149 the fractional part of the ſine to its logarithm, obſerving the point, thus,

$$\left.\begin{array}{lr} & 29.854 \\ & 149 \\ \hline \text{the ſum} & 30.003 \end{array}\right\} \text{is the logarithm of the round number 999700.000 nearly.}$$

24. *Prop.* Of three equidifferent quantities, the meaſure

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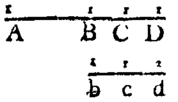
ſure of the proportion between the two greater terms, with the meaſure of the proportion between the two leſs terms, will conſtitute a proportion which will be greater than the proportion of the two greater terms, but leſs than the proportion of the two leaſt.



Thus if AB, AC, AD, be three quantities having the equal differences BC, CD; and if the meaſure of the proportion of AD, AC be cd and that of AC, AB, be cb; then the proportion of cd to cb will be greater than the proportion of AC to AD, but leſs than the proportion of AB to AC.

25. *Prop.* The ſaid proportion between the two meaſures is leſs than half the proportion between the extreme terms: that is, the proportion between bc, cd, is leſs than half the proportion between AB, AD.

Corol. Since therefore the arithmetical mean divides the proportion into unequal parts, of which the one is greater and the other leſs than half the whole; if it be enquired what proportion is between theſe proportions, the anſwer is, that it is a little leſs than the ſaid half.

An example of finding nearly the limits greater and leſs, to the meaſure of any propoſed proportion.—It being known that the meaſure of the proportion between 1000 and 900 is 10536.05, required the meaſure of the proportion 900 to 800, where the terms 1000, 900, 800, have equal differences. Therefore as 9 to 10, ſo 10536.05 to 11706.72, which is leſs than 11778.30, the meaſure of the proportion 9 to 8. Again, as the mean proportion between 8 and 10 (which is 8.9442719) is to 10, ſo is 10536.05 to 11779.66, which is greater than the meaſure of the proportion between 9 and 8.

Axiom. Every number denotes an expreſſible quantity.

26. *Prop.* If the 1000 numbers, differing by 1, follow one another in the natural order, and there be taken any two adjacent numbers, as the terms of ſome proportion; the meaſure of the proportion will be to the meaſure of this proportion between the two greateſt terms of the chiliad, in a proportion greater than that which the greateſt term 1000 bears to the greater of the two terms firſt taken, but leſs than the proportion of 1000 to the leſs of the ſaid two ſelected terms.

So of the 1000 numbers taking any two ſucceſſive terms, as 501 and 500, the logarithm of the former being 69114.92, and of the latter 69314.72, the difference of which is 199.80. Wherefore by the definition, the meaſure of the proportion between 501 and 500 is 199.80. In like manner, becauſe the logarithm of the greateſt term 1000 is 0, and of the next 999 is 100.05, the difference of theſe logarithms, and the meaſure of the proportion between 1000 and 999, is 100 05. Couple now the greateſt term 1000 with each of the ſelected terms 501 and 500; couple alſo the meaſure 199.80 with the meaſure 100.05: ſo ſhall the proportion between 199.80 and 1000.05 be greater than the proportion between 1000 and 501, but leſs than the proportion between 1000 and 500.

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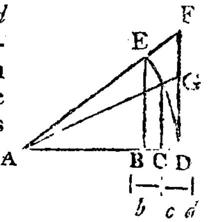
Corol. 1. Any number below the firſt 1000 being propoſed, as alſo its logarithm; the differences of any logarithms antecedent to that propoſed, towards the beginning of the chiliad, are to the firſt logarithm (viz. that which is aſſigned to 999) in a greater proportion than 1000 to the number propoſed; but of thoſe which follow towards the laſt logarithm, they are to the ſame in a leſs proportion.

Corol. 2. By this means the places of the chiliad may eaſily be filled up, which have not yet had logarithms adapted to them by the former propoſitions.

27. *Prop.* The difference of two logarithms, adapted to two adjacent numbers, is to the difference of theſe numbers in a proportion greater than 1000 bears to the greater of thoſe numbers, but leſs than that of 1000 to the leſs of the two numbers.

This 27th propoſition is the ſame as Napier's ſecond rule.

28. *Prop.* Having given two adjacent numbers of the 1000 natural numbers, with their logarithmic indices, or the meaſures of the proportions which thoſe abſolute or round numbers conſtitute with 1000 the greateſt; the increments or differences of theſe logarithms will be to the logarithm of the ſmall element of the proportions as the ſecants of the arcs whoſe coſines are the two abſolute numbers is to the greateſt number, or the radius of the circle; ſo that, however, of the ſaid two ſecants, the leſs will have to the radius a leſs proportion than the propoſed difference has to the firſt of all, but the greater will have a greater proportion, and ſo alſo will the mean proportional between the ſaid ſecants have a greater proportion.



Thus if BC, CD be equal, alſo *bd* the logarithm of AB, and *cd* the logarithm of AC; then the proportion of *bc* to *cd* will be greater than the proportion of AG to AD, but leſs than that of AF to AD, and alſo leſs than that of the mean proportional between AF and AG to AD.

Corol. 1. The ſame obtains alſo when the two terms differ, not only by the unit of the ſmall element, but by another unit which may be ten fold, a hundred fold, or a thouſand fold of that.

Corol. 2. Hence the differences will be obtained ſufficiently exact, eſpecially when the abſolute numbers are pretty large, by taking the arithmetical mean between two ſmall ſecants, or (if you will be at the labour) by taking the geometrical mean between two larger ſecants, and then by continually adding the differences, the logarithms will be produced.

Corol. 3. *Precept.* Divide the radius by each term of the aſſigned proportion, and the arithmetical mean (or ſtill nearer the geometrical mean) between the quotients will be the required increment, which being added to the logarithm of the greater term, will give the logarithm of the leſs term.

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EXAMPLE.

Let there be given the logarithm of 700, viz. 35667.4948, to find the logarithm to 699.
Here radius divided by 700 gives 1428571, &c.
and divided by 699 gives 1430672, &c.
the arithmetic mean is 142.962
which added to 35667.4948

gives the logarithm to 669 35810.4568

Corol. 4. *Precept* for the logarithms of ſines.

The increment between the logarithms of two ſines is thus found: find the geometrical means between the coſecants, and divide it by the difference of the ſines, the quotient will be the difference of the logarithms.

EXAMPLE.

0° 1′ ſine 2909 coſec. 343774682
0 2 ſine 5818 coſec. 171887319

dif. 2909 geom. mean 2428 nearly.

The quotient 80000 exceeds the required increment of the logarithms, becauſe the ſecants are here ſo large.

Appendix. Nearly in the ſame manner it may be ſhown, that the ſecond differences are in the duplicate proportion of the firſt, and the third in the duplicate of the ſecond. Thus, for inſtance, in the beginning of the logarithms, the firſt difference is 100.00000, *viz.* equal to the difference of the numbers 100000.00000 and 99900.00000; the ſecond, or difference of the differences, 10000; the third 20. Again, after arriving at the number 50000.00000, the logarithms have for a difference 200.00000, which is to the firſt difference as the number 100000.00000 to 50000.00000; but the ſecond difference is 40000, in which 10000 is contained four times; and the third 328, in which 20 is contained ſixteen times. But ſince, in treating of new matters, we labour under the want of proper words, wherefore, leaſt we ſhould become too obſcure, the demonſtration is omitted untried.

29. *Prop.* No number expreſſes exactly the meaſure of the proportion between two of the 1000 numbers conſtituted by the foregoing method.

30. *Prop.* If the meaſures of all proportions be expreſſed by numbers or logarithms; all proportions will not have aſſigned to them their due portion of meaſure, to the utmoſt accuracy.

31. *Prop.* If to the number 1000, the greateſt of the chiliad, be referred others that are greater than it, and the logarithm of 1000 be made 0, the logarithms belonging to thoſe greater numbers will be negative.

This concludes the firſt or ſcientific part of the work; the principles of which Kepler applies, in the ſecond part, to the actual conſtruction of the firſt 1000 logarithms, which is pretty minutely deſcribed. This part is intitled *A very compendious method of conſtructing the Chiliad of Logarithms:* and it is not improperly ſo called, the method being very conciſe and eaſy. The fundamental principles are briefly theſe: That at the beginning of the logarithms their increments or differences are equal to thoſe of the natural numbers: that the natural numbers may be conſidered as the decreaſing coſines of increaſing arcs: and that the ſecants of thoſe arcs at the beginning have the ſame differences as the coſines, and therefore the ſame differences as the logarithms. Then, ſince the ſecants are the reciprocals of the coſines, by theſe principles and the third corol. to the twenty-eighth propoſition, he eſtabliſhes the following method of conſtituting the 100 firſt or ſmalleſt logarithms to the 100 largeſt numbers, 1000, 999, 998, 997, &c. to 900, *viz.* Divide the radius 1000, increaſed with ſeven ciphers, by each of theſe numbers ſeparately, diſpoſing the quotients in a table and they will be the ſecants of thoſe arcs which have the diviſors for their coſines; continuing the diviſion to the 8th figure, as it is in that place only that the arithmetical and geometrical means differ. Then, by adding ſucceſſively the arithmetical means between every two ſucceſſive ſecants, the ſums will be the ſeries of logarithms. Or, by adding continually every two ſecants, the ſucceſſive ſums will be the ſeries of the double logarithms.

Beſides theſe 100 logarithms thus conſtructed, he conſtitutes two others by continual biſection or extractions of the ſquare root, after the manner deſcribed in the ſecond poſtulate. And firſt he finds the logarithm which meaſures the proportion between 100000.00 and 97656.25, which latter term is the third proportional to 1024 and 1000, each with two cyphers; and this is effected by means of twenty-four continual extractions of the ſquare root, determining the greateſt term of each of twenty-four claſſes of mean proportionals; the difference between the greateſt of theſe means and the firſt or whole number 1000, with cyphers, being as often doubled, there ariſes 2371.6526 for the logarithm ſought, which made negative is the logarithm of 1024. Secondly the like proceſs is repeated for the proportion between the numbers 1000 and 500, from which ariſes 69314.7193 for the logarithm of 500; which he alſo calls the logarithm of duplication, being the meaſure of the proportion of 2 to 1.

Then from the foregoing he derives all the other logarithms in the chiliad, beginning with thoſe of the prime numbers, 1, 2, 3, 5, 7, &c. in the firſt 100. And firſt, ſince 1024, 512, 256, 128, 64, 32, 16, 8, 4, 2, 1, are all in the continued proportion of 1000 to 500, therefore the proportion of 1024 to 1 is decuple of the proportion of 1000 to 500, and conſequently the logarithm of 1 would be decuple of the logarithm 500, if 0 were taken as the logarithm of 1024; but ſince the logarithm of 1024 is applied negatively, the logarithm of 1 muſt be diminiſhed by as much: diminiſhing therefore 10 times the logarithm of 500, which is 693147.1928, by 2371.6526, the remainder 690775.5422 is the logarithm of 1, or of 100,00 what is ſet down in the table.

And becauſe 1, 10, 100, 1000, are continued proportionals, therefore the proportion of 1000 to 1 is triple of the proportion of 1000 to 100, and conſequently $\frac{1}{3}$ of the logarithm of 1 is to be put for the logarithm of 100, *viz.* 230258.5141, and this is alſo the logarithm of decuplication, or of the proportion of 10 to 1. And hence

Nos.	Logarithms.
100	230258.5141
10	460517.0282
1	690775.5422
.1	921034.0563
.01	1151292.5703
.001	1381551.0844
.0001	1611809.5985

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hence multiplying this logarithm of 100 ſucceſſively by 2, 3, 4, 5, 6, and 7, there ariſe the logarithms to the numbers in the decuple proportion as under.

Alſo if the logarithm of duplication, or of the proportion of 2 to 1, be taken from the logarithm of 1, there will remain the logarithm of 2; and from the logarithm of 2 taking the logarithm of 10 there remains the logarithm of the proportion of 5 to 1; which taken from the logarithm of 1, there remains the logarithm of 5. See the margin.

Log. of 1	690775.5422
of 2 to 1	69314.7193
log. of 2	621460.8229
log. of 10	460517.0281
of 5 to 1	160943.7948
log. of 5	529831.7474

For the logarithms of other prime numbers, he has recourſe to thoſe of ſome of the firſt or greateſt century of numbers before found, viz. of 999, 998, 997, &c. And firſt taking 960, whoſe logarithm is 4082.2001; then by adding to this logarithm the logarithm of duplication, there will ariſe the ſeveral logarithms of all theſe numbers, which are in duplicate proportion continued from 960, namely 480, 240, 120, 60, 30, 15. Hence the logarithm of 30 taken from the logarithm of 10, leaves the logarithm of the proportion of 3 to 1; which taken from the logarithm of 1, leaves the logarithm of 3, viz. 580914.3106. And the double of this diminiſhed by the logarithm of 1, gives 4710, 53.0790 for the logarithm of 9.

Next, from the logarithm of 990, or 9 × 10 × 11, which is 1005.0331, he finds the logarithm of 11; namely, ſubtract the ſum of the logarithms of 9 and 10 from the ſum of the logarithm of 990, and double the logarithm of 1, there remains 450986.0106 the logarithm of 11.

Again, from the logarithm of 980, or 2 × 10 × 7 × 7, which is 2020.2711, he finds 496184.5228 for the logarithm of 7.

And from 5129.3303 the logarithm of 950 or 5 × 10 × 19, he finds 396331.6392 for the logarithm of 19.

In like manner the logarithm
to 998 or 4 × 13 × 19, gives the logarithm of 13;
to 969 or 3 × 17 × 19, gives the logarithm of 17;
to 986 or 2 × 17 × 29, gives the logarithm of 29;
to 966 or 6 × 7 × 23, gives the logarithm of 23;
to 930 or 3 × 10 × 31, gives the logarithm of 31.

And ſo on for all the primes below 100, and for many of the primes in the other centuries up to 900. After which he directs to find the logarithms of all numbers compoſed of theſe, by the proper addition and ſubtraction of their logarithms, namely, in finding the logarithm of the product of two numbers, from the ſum of the logarithms of the two factors take the logarithm of 1, the remainder is the logarithm of the product. In this way he ſhows, that the logarithms of all numbers under 500 may be derived, except thoſe of the following 36 numbers, namely 127, 149, 167, 173, 179, 211, 223, 251, 257, 263, 269, 271, 277, 281, 283, 293, 337, 347, 349. 353, 359, 367, 373, 379, 383, 389, 397, 401, 409, 419, 421, 431. 433, 439, 443, 449. Alſo, beſides the compoſite numbers, between 500 and 900, made up of the products of ſome numbers whoſe logarithms have been before determined, there will be 59 primes not compoſed of them which with the 36 abovementioned make 95 numbers in all not compoſed of the products of any before them, and the logarithms of which he directs to be derived in this manner; namely, by conſidering the differences of the logarithms of the numbers interſperſed among them; then by that method by which were conſtituted the differences of the logarithms of the ſmalleſt 100 numbers in a continued ſeries, we are to proceed here in the diſcontinued ſeries, that is, by prop. 28th, corol. 3d, and eſpecially by the appendix to it, if it be rightly uſed, from whence thoſe differences will be very eaſily ſupplied.

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§. 3. *Mr Briggs's Method.*

The methods principally made uſe of by this gentleman were publiſhed in Napier's poſthumous work. Having ſuppoſed 0 to be the logarithm of 1, and 1 with any number of ciphers annexed, ſuppoſe 10 to be the logarithm of 10, this number is to be divided ten times by 5, which in a logarithmic number is equivalent to the extraction of the root of the fifth power; by which means he obtains the following numbers, viz. 2 with nine ciphers to it; 4 with eight ciphers; 8 with ſeven ciphers; 16 with ſix ciphers; 32 with five ciphers; 64 with four; 128000, 25600, 5120, and 1024. Dividing this laſt logarithm ten times by 2, we have a geometrical ſeries of ten numbers; the firſt of which is 512, and the laſt 1. Thus 20 logarithms are obtained: but the labour of finding the numbers belonging to them is ſo exceſſive, that it is ſurpriſing how it could be undergone by any body. To obtain thoſe correſponding to the firſt ten logarithms, the fifth root muſt be extracted ten times, and the ſquare root as often, to obtain the numbers correſponding to the others. The power from which theſe extractions is made, muſt originally be 1, with a number of ciphers annexed. Other logarithms might be formed from theſe by adding them, and multiplying their correſponding numbers; but as this method, beſides its exceſſive labour, would produce only an *antilogarithmic* canon like that of Mr Dodſon already mentioned, other more eaſy and proper methods were thought of.

The next was by finding continually geometrical means, firſt between 10 and 1, and then between 10 and that mean, and ſo on, taking the arithmetical means between their correſponding logarithms. The operation is alſo facilitated by various properties of numbers and their logarithms, as that the products and quotients of numbers correſpond to the ſums and differences of their logarithms; that the powers and roots of numbers anſwer to the products and quotients of the logarithms by the index of the power or root. Thus having the logarithm of 2, we can have thoſe of 4, 16, 256, &c. by multiplying the logarithms of 2, and ſquaring the numbers to as great an extent in that ſeries as we pleaſe. If we have alſo that of 3, we can not only have thoſe of 9, 81, 8561, &c. but of 6, 18, 27, and all poſſible products of the powers of 2 and 3 into one another, or into the numbers themſelves. The following property may alſo be of uſe, viz. that if the logarithms of any two numbers are given, and each number be raiſed to the power denoted by the index of the other, the products will be equal. Thus,

Log.	0	1	2	3	4	5	6
Nat. num.	1	2	4	8	16	32	64

Let the two numbers be 4 and 16; it is plain, that if we raiſe 4 to the fourth power and 16 to the ſquare, the products will be the ſame; for $16\times16=256$, and $4\times4=16$; $16\times4=64$; and $64\times4=256$.

Another method mentioned by Mr Briggs depends upon this property, that the logarithm of any number in this ſcale is 1 leſs than the number of places or figures contained in that power of that number whoſe exponent is the logarithm of 10, at leaſt as to integral numbers; for Mr Briggs has ſhown that they really differ by a fraction. To this Mr Hutton adds the following; *viz.* that of any two numbers, as the greater is to the leſs, ſo is the velocity of the increment or decrement of the logarithms to the greater; "that is (ſays he), in our modern notation, as $X . Y : y : x$; where x and y are the fluxions of X and Y.

In the treatiſe written upon the conſtruction of logarithms by Mr Briggs himſelf, he obſerves, that they may be conſtructed chiefly by the two methods already mentioned, concerning which he premiſes ſeveral lemmata concerning the powers of numbers and their indices, and how many places of figures are in the products of numbers. He obſerves, that theſe products will conſiſt of as many figures as there are in both factors, unleſs the firſt figures in each factor be expreſſed in one figure only, which ſometimes happens, and then there will commonly be one figure leſs in the product than in the two factors. He obſerves alſo, that if in any ſeries of geometricals, we take two terms, and raiſe one to the power denoted by the index of the other, or any number raiſed to the power denoted by the logarithm of the other, the product will be equal to this latter number raiſed to the power denominated by the logarithm of the former. Hence, if one of the numbers be 10, whoſe logarithm is 1 with any number of cyphers, then any number raiſed to the power whoſe index is the logarithm of that number, that is, the logarithm of any number in this ſcale where 1 is the logarithm of 10, is the index of that power of 10, which is equal to the given number. But the index of any integral power of 10 is one leſs than the number of places of figures it contains. Thus the ſquare of 10, or 100, contains three places of figures, which is more by one, than 2 the index of the power; 1000, the cube of 10 contains four places, which is one more than the index, 3, of the power. Hence as the number of places of the powers of 10 are always exactly one more than the indices of thoſe powers, it follows that the places of figures in the powers of any other number which is no integral power of 10, will not always be exactly one leſs in number than the indices of the powers. From theſe two properties is deduced the following rule for finding the logarithms of many prime numbers.

Find the 10th, 100th, 1000th, or any other power of a number, ſuppoſe 2, with the number of places of figures in it, then that number of figures ſhall always exceed the logarithm of 2, although the exceſs will be conſtantly leſs than 1; whence by proceeding to very high powers we will at laſt be able to obtain the logarithm of the number to great exactneſs.

Thus, the logarithm of 2, found by other methods, is known to be 30102999566389, &c. The tenth power of 2 is 1024, which containing four places of figures, gives 4 for the logarithm of 2, which exceeds it, though not quite by 1. The 20th power of 2, conſiſting of the 10th power multipled into itſelf, by its number of places ought to give the logarithm of 4; and according to the rule already laid down, ſhould contain eight places of figures: but by reaſon of the cypher which ſtands in the ſecond place, it is eaſy to ſee that it muſt contain only ſeven; which therefore gives ſeven for the logarithm of four. The logarithm of 16 is then expreſſed by the number of places of figures in the product of the 20th power of 2 into itſelf; and is therefore denominated by 13. That of 256 is denoted by the 80th power of 2, containing 25 places of figures. The logarithm of 2, therefore, having been already expreſſed by the 10th power of 2, will be again expreſſed by the 100th power. Adding, therefore, the number of places contained in the 80th power, *viz.* 25 to 7, the number of places contained in the 20th, we have 32 for the next expreſſion of that logarithm. On account of the cypher which ſtands in the ſecond place of one of the factors, however, we muſt deduct one from the number; and thus we have 31 for the logarithm of 2, which is a conſiderable approximation. Proceeding in this manner, at the 1000th power of 2, we have 302 for the logarithm of 2; at the 10,000th power we have 3011; at the 100,000th power, 30103; at the 1,000,000th, we have 301030; and at the 10,000,000th power, we obtain 3010300: which is as exact as is commonly expreſſed in the tables of logarithms; but by proceeding in the ſame manner we may have it to any degree of exactneſs we pleaſe. Thus, at the 100,000,000th power, we have 30103000; and at the 1,000,000,000, the logarithm is 301029996, true to eight places of figures.

The only difficulty in this method is to find the number of places of figures in the different powers without multiplying them; but this may be determined by only multiplying the firſt five; or even the firſt three of the products will be ſufficient to determine this; and the logarithms may thus be found with very great facility.

When the logarithms, however, are required to a very great degree of exactneſs, our author thinks that the method of mean proportionals is moſt eligible. This conſiſts in finding a great number of mean proportionals betwixt 1 and the number propoſed; that is, firſt extracting the ſquare root of the number itſelf, then extracting the root of that root, &c. until the laſt root ſhall exceed 1 only by a very ſmall decimal. Finding then the logarithm of this number by methods hereafter to be deſcribed, he multiplies it by the index of the power of 2, denoted by the number of extractions of the ſquare root; and the reſult is the required logarithm of the given number. In this method, the number of decimal places contained in the laſt root ought to be double the number of true places required in the logarithm itſelf, and the firſt half of them ought to be cyphers; the integer being 1. To find out the firſt ſmall number and its logarithm, our author begins with 10 and its logarithm 1; continually extracting the root of the former, and biſecting the latter, till he comes to the 54th root, and then finds, that at the 53d and 54th roots both natural numbers and logarithms bear the ſame proportion to each other, viz. that of 2 to 1. Thus,

	Numbers.
53	1.00000,00000,00000,25563,82986,40064,70
54	1.00000,00000,00000,12781,91493,20032,35

Logarithm.
53|0.00000,00000,00000,11102,23024.62515,65404
54|0.00000,00000,00000,05551,11512,31257,82702.

If now by continual extraction and biſection we find any other ſmall number it will then be, as 12781, &c. is to 5551, &c. ſo is that other ſmall decimal to the correſpondent ſignificant figures of its logarithm. To avoid, however, the exceſſive labour of ſuch long multiplications and diviſions, he reduces this ratio to another, the antecedent of which is 1. Thus, as 12781, &c. is to 5551, &c. ſo is 1 with as many ciphers annexed as precede the logarithms abovementioned, viz. 15, with another unit annexed to a 4th number, which will be the ſignificant figures of the logarithm of the third term. The proportions then will be

12781 &c. : 5551 &c. :: 1.00000,00000,00000,1 : 4342944819032518040;

this laſt number, with 17 ciphers prefixed, being the logarithm of the one immediately preceding it. Having therefore found by continual extraction any ſuch ſmall decimal as the above, multiply it by 4242, &c. and the product will be the correſponding logarithm of the laſt root.

Still, as the labour of ſo many extractions muſt be intolerably tedious, it became neceſſary to fall upon ſome contrivances to ſhorten ſuch operations; and of theſe the following is an example.

Let the number of which we ſeek the logarithm be involved to ſuch an height that the index of the power may be one, with either one or more ciphers next to it. Divide this power then by 1 with as many ciphers annexed as the power has ſignificant figures after the firſt; or, ſuppoſing all the figures after the firſt to be decimals, the roots are extracted continually from this power, till the decimal becomes ſufficiently ſmall, as when the firſt 15 places are ciphers; then, multiplying the decimal by 43429, &c. we have the logarithm of this laſt root; which logarithm multiplied by the like power of the number 2, gives the logarithm of the firſt number of which the extraction was begun. To this logarithm if we prefix 1, 2, 3, &c. according as this number was found by dividing the power by 10, 100, 1000, &c. and laſtly, dividing the reſult by the index of that power, the quotient will be the required logarithm of the given prime number.

Thus to find by this method the logarithm of 2. Raiſe it firſt to the 10th power, which is 1024; then cutting off for decimals the laſt three figures, we continually extract the ſquare root from 1,024 forty-ſeven times, which gives 1.00000,00000,00000,16851,60570,53949,77; the decimal part of which multiplied by 43429, &c. gives 0.00000,00000,00000,07318,55936,90623,9368 for its logarithm, which being continually doubled 47 times, or multiplied at once by the 47th power of 2, viz. 140737488355328, gives for the logarithm of the number 10240.01029,99566,39811,95265,27744, true to 17 or 18 places of decimals; then prefixing to this number 3, becauſe the diviſion was made by 1000 (for cutting off the three places of decimals is the ſame as dividing by 1000), we have for the logarithm of 1024, 3.010299566, &c. as above. Laſtly, dividing by 10, becauſe 1024 is the 10th power of 2, we have the logarithm of 2 itſelf; viz. 0. 30102, &c.

The involving of any number to a very high power is by no means a matter of ſuch difficulty as might at firſt ſight be imagined. A number multiplied by itſelf produces the *ſquare*; the ſquare multiplied by itſelf produces the *biquadrate*; the biquadrate multiplied by itſelf gives the eighth power, and the eighth power multiplied by the ſquare produces the tenth. The tenth power multiplied by itſelf gives the 20th, and the 20th multiplied by itſelf gives the 40th. The eighth power divided by the original number gives the ſeventh; and the 40th power multiplied by the ſeventh gives the 47th power required.

The *differential* method of conſtructing logarithms was likewiſe invented by our author, and greatly ſhortens the labour of finding the mean proportionals. Mr Briggs, in the courſe of his calculations, had obſerved, that theſe proportionals, found by continual extraction of roots, gradually approach nearer and nearer to the halves of the preceding root; and that as many ſignificant figures as there are cyphers before them, agree exactly in this proportion. Subtracting therefore each of theſe decimal parts, which he called A, or the firſt differences, from half the next preceding one, and by comparing together the remainders or ſecond differences, called B, he found that the ſucceding were always nearly equal to $\frac{1}{4}$ of the next preceding ones; then taking the difference between each ſecond difference and $\frac{1}{4}$ of the preceding one, he found that theſe third differences, called C, were nearly in the continual ratio of 8 to 1; again taking the difference between each C and $\frac{1}{8}$ of the next preceding, he found that theſe third differences, called D, were nearly in the continual ratio of 16 to 1; and ſo on, the 5th (E), 6th (F), &c. differences, being nearly in the continual ratio of 32 to 1, of 64 to 1, &c.: theſe plain obſervations being made they very naturally and clearly ſuggeſted to him the notion and method of conſtructing all the remaining numbers from the differences of a few of the firſt, found by extracting the roots in the uſual way. This will evidently appear from the annexed ſpecimen of a few of the firſt numbers in the laſt example for finding the logarithm of 6; where after the 9th number the reſt are ſuppoſed to be conſtructed from the preceding differences of each, as here ſhown in the 10th and 11th. And it is evident that, in proceeding, the trouble will become always leſs and leſs; the differences gradually vaniſhing, till at laſt only the firſt differences remain. And that generally each leſs difference is ſhorter than the next greater, by as many places as there are cyphers at the beginning of the decimal in the number to be generated from the differences.

	1,00776,96	
1	1,00387,72833,36962,45663,84655,1	
2	1,00193,67661,36946,61675,87022,9	
3	1,00096,79146,39099,01728,89072,0	
4	1,00048,38402,68846,62985,49253,5	A
5	1,00024,18908,78824,68563,80872,7	A
	24,19201,34423,31492,74626,7	$\frac{1}{2}$A
	292,55598,62928,93754,0	B
6	1,00012,09381,26397,13459,43919,4	A
	12,09454,39412,34281,90436,3	$\frac{1}{2}$A
	73,13015,20822,46516,9	B
	73,13899,65732,23438,5	$\frac{1}{4}$B
	884,44909,76921,5	C
7	1,00006,04672,35055,30968,01600,5	A
	6,04690,63198,56729,71959,7	$\frac{1}{2}$A
	18,28143,25761,70359,2	B
	18,28253,80205,61629,2	$\frac{1}{4}$B
	110,54443,91270,0	C
	110,55613,72115,2	$\frac{1}{8}$C
	1169,80845,2	D
8	1,00003,02331,60505,65775,96479,4	A
	3,02336,17527,65484,00800,2	$\frac{1}{2}$A
	4,57021,99708,04320,8	B
	4,57035,81440,42589,8	$\frac{1}{4}$B
	13,81732,38269,0	C
	13,81805,48908,5	$\frac{1}{8}$C
	73,10639,7	D
	73,11302,8	$\frac{1}{16}$D
	663,1	E

9		1,00001,51164,65999,05672,95048,8	A
		1,51165,80252,82887,98239,7	$\frac{1}{2}$A
		1,14253,77215,03190,9	B
	Hitherto the	1,14255,49927,01080,2	$\frac{1}{4}$B
	ſmaller differences	1,72711,97889,3	C
	are found by ſub-	1,72716,54783,6	$\frac{1}{8}$C
	tracting the larger from	4,56894,3	D
	the parts of the like pre-	4,56915,0	$\frac{1}{16}$D
	ceding ones.	20,7	E
		20,7	$\frac{1}{32}$E
	Here the greater differences	65	$\frac{1}{32}$E
	remain after ſubtracting	28555,89	$\frac{1}{16}$D
	the ſmaller from the parts	28555,24	D
	of the difference of	21588,99736,16	$\frac{1}{8}$C
	the next preceding	21588,71180,92	C
	number.	28563,44303,75797,72	$\frac{1}{4}$B
		28563,22715,04616,80	B
		75582,32999,52836,47524,40	$\frac{1}{2}$A
10		1,00000,75582,04436,30121,42907,60	A
		2	$\frac{1}{32}$E
		1784,70	$\frac{1}{16}$D
		1784,68	D
		2698,58897,62	$\frac{1}{8}$C
		2698,57112,94	C
		7140,80678,76154,20	$\frac{1}{4}$B
		7140,77980,19041,26	B
		37791,02218,15060,71453,80	$\frac{1}{2}$A
11		1,00000,37790,95077,37080,52412,54	A

He then concludes this chapter with an ingenious, but not obvious, method of finding the differences B, C, D, E, &c. belonging to any number, as ſuppoſe the 9th, from that number itſelf, independent of any of the preceding 8th, 7th, 6th, 5th, &c.; and it is this: Raiſe the decimal A to the 2, 3d, 4th, 5th, &c. powers; then will the 2d (B), 3d (C), 4th (D), &c. differences be as here below, viz.

$B=\frac{1}{2}A^2,$

$C= \ldots \frac{1}{2}A^3 \times \frac{1}{8}A^4,$

$D= \ldots \frac{7}{8}A^4 \times \frac{7}{8}A^5 + \frac{7}{16}A^6 + \frac{1}{8}A^7 + \frac{1}{64}A^8,$

$E= \ldots 2\frac{5}{8}A^5 + 7A^6 + 10\frac{15}{16}A^7 + 12\frac{69}{128}A^8 + 11\frac{11}{64}A^9 + 7\frac{105}{128}A^{10},$

$F= \ldots 13\frac{9}{16}A^6 + 81\frac{3}{8}A^7 + 296\frac{87}{28}A^8 + 834\frac{43}{128}A^9 + 1953\frac{285}{512}A^{10},$ &c.

$G= \ldots 122\frac{1}{16}A^7 + 1510\frac{67}{128}A^8 + 11475\frac{73}{128}A^9 + 68372\frac{79}{2048}A^{10},$ &c.

$H= \ldots 1937\frac{95}{128}A^8 + 47151\frac{93}{128}A^9 + 706845\frac{1493}{8192}A^{10},$ &c.

$I= \ldots 54902\frac{89}{128}A^9 + 2558465\frac{23587}{32768}A^{10},$ &c.

$K= \ldots 2805527A^{10},$ &c.

&c.

Thus in the 9th number of the foregoing example, omitting the ciphers at the beginning of the decimals, we have

$A = 1,51164,65999,05672,95048,8$

$A^2 = - \; 2,28507,54430,06381,6726$

$A^3 = - - - \; 3,45422,65239,48546,2$

$A^4 = - - - - \; 5,22156,97802,288$

$A^5 = - - - - - - \; 7,89316,8205$

$A^6 = - - - - - - - \; 11,93168,1$

&c.

Conſequently

$A\frac{1}{2}{}^2 = 1,14253,77215,03190,8363 \quad = B$

$\frac{1}{2}A^3 \; - \; 1,72711,32619 \cdot 74273$

$\frac{1}{8}A^4 \; - - - \; 65269 \cdot 62225$

$\frac{1}{2}A^3 + \frac{1}{8}A^4 \quad 1 \cdot 72711,97889,36498 \quad = C$

$\frac{7}{8}A^4 \quad 4,56887 \cdot 35577$

$\frac{7}{8}A^5 \; - - \; 6,90652$

$\frac{7}{16}A^6 \; - - - - \; 5$

$\frac{7}{8}A^4 + \frac{7}{8}A^5 + \frac{7}{16}A^6 \quad 4,56894,26234 \quad = D$

$2\frac{5}{8}A^5 \; - - \; 20,71957$

$7A^6 \; - - \; 83$

$2\frac{5}{8}A^5 + 7A^6 \; - - - \; 20,72040 \quad = E$

which agree with the like differences in the foregoing ſpecimen.

§ 4 *Of Curves related to Logarithms.*

Several other ingenious methods and improvements are laid down by our author in his treatiſe upon this ſubject; but as all theſe were attended with great labour, mathematicians ſtill continued their efforts to facilitate the work; and it was ſoon perceived that ſome curves had properties analogous to logarithms. Edmund Gunter, it has been ſaid, firſt gave the idea of a curve, whoſe abſciſſes are in arithmetical progreſſion, while the correſponding ordinates are in geometrical progreſſion, or whoſe abſciſſes are the logarithms of their ordinates; but it is not noticed in any part of his writings. The ſame curve was afterwards conſidered

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conſidered by others, and named the *logarithmic* or *logiſtic* curve by Huygens in his *Diſſertatio de Cauſa Gravitatis*, where he enumerates all the principal properties of this curve, ſhowing its analogy to logarithms. Many other learned men have alſo treated of its properties; particularly Le Seur and Jacquier in their comment on Newton's Principia; Dr John Kiel in the elegant little tract on logarithms ſubjoined to his edition of Euclid's Elements; and Frances Maſeres, Eſq. curſitor baron of the Exchequer, in his ingenious treatiſe on Trigonometry; in which book the doctrine of logarithms is copiouſly and learnedly treated, and their analogy to the logarithmic curve, &c. fully diſplayed. It is indeed rather extraordinary that this curve was not ſooner announced to the public; ſince it reſults immediately from Baron Napier's manner of conceiving the generation of logarithms, by only ſuppoſing the lines which repreſent the natural numbers to be placed at right angles to that upon which the logarithms are taken. This curve geartly facilitates the conception of logarithms to the imagination, and affords an almoſt intuitive proof of the very important property of their fluxions, or very ſmall increments, *viz.* that the fluxion of the number is to the fluxion of the logarithm, as the number is to the ſubtangent; as alſo of this property, that, if three numbers be taken very nearly equal, ſo that their ratios to each other may differ but a little from a ratio of equality; as for example the 3 numbers 10,000,000, 10,000,001, 10,000,002, their differences will be very nearly proportional to the logarithms of the ratios of thoſe numbers to each other all which follow from the logarithmic arcs being very little different from their chords, when they are taken very ſmall. And the conſtant ſubtangent of this curve is what was afterwards by Cotes called the *modulus* of the ſyſtem of logarithms: and ſince by the former of the two properties abovementioned, this ſubtangent is a fourth proportional to the fluxion of the number, the fluxion of the logarithm, and the number, this property afforded occaſion to Mr. Baron Maſeres to give the following definition of the *modulus*, which is the ſame in effect as Cotes's, but more clearly expreſſed; namely, that it is the limit of the magnitude of a fourth proportional to theſe three quantities, *viz.* the difference of any two natural numbers that are very nearly equal to each other, either of the ſaid numbers and the logarithm or meaſure of the ratio they have to each other. Or we may define the *modulus* to be the natural number at that part of the ſyſtem of logarithms, where the fluction of the number is equal to the fluxion of the logarithm, or where the numbers and logarithms have equal differences. And hence it follows, that the logarithms of equal numbers or of equal ratios, in different ſyſtems, are to one another as the *moduli* of thoſe ſyſtems. Moreover, the ratio whoſe meaſure or logarithm is equal to the *modulus*, and thence by Cotes called the *ratio modularis*, is by calculation found to be the ratio of 2·718281828459, &c. to 1, or of 1 to ·367879441171, &c.: the calculation of which number may be ſeen at full length in Mr Baron Maſeres's treatiſe on the Principle of Life-annuities, p. 274 and 275.

The hyperbolic curve alſo afforded another ſource for developing and illuſtrating the properties and conſtruction of logarithms. For the hyperbolic areas lying between the curve and one aſymptote, when they are bounded by ordinates parallel to the other aſymptote, are analogous to the logarithms of their abſciſſes or parts of the aſymptote. And ſo alſo are the hyperbolic ſectors; any ſector bounded by an arc of the hyperbola and two radii being equal to the quadrilateral ſpace bounded by the ſame arc, the two ordinates to either aſymptote from the extremities of the arc and the part of the aſymptote intercepted between them. And although Napier's logarithms are commonly ſaid to be the ſame as hyperbolic logarithms, it is not to be underſtood that hyperbolas exhibit Napier's logarithm's only, but indeed all other poſſible ſyſtems of logarithms whatever. For, like as the right angled hyperbola, the ſide of whoſe ſquare inſcribed at the vertex is 1, gives us Napier's logarithms; ſo any other ſyſtem of logarithms is expreſſed by the hyperbola whoſe aſymptotes form a certain oblique angle, the ſide of the rhombus inſcribed at the vertex of the hyperbola in this caſe alſo being ſtill 1, the ſame as the ſide of the ſquare in the right-angled hyperbola. But the areas of the ſquare and rhombus, and conſequently the logarithms of any one and the ſame number or ratio, will differ according to the ſine of the angle of the aſymptotes. And the area of the ſquare or rhombus, or any inſcribed parallelogram, is alſo the ſame thing as what was by Cotes called the *modulus of the ſyſtem of logarithms*; which modulus will therefore be expreſſed by the numerical meaſure of the ſine of the angle formed by the aſymptotes, to the radius 1; as that is the ſame with the number expreſſing the area of the ſaid ſquare or rhombus, the ſide being 1: which is another definition of the modulus to be added to thoſe we before remarked above in treating of the logarithmic curve. And the evident reaſon of this is, that in the beginning of the generation of theſe areas from the vertex of the hyperbola, the naſcent increment of the abſciſſe drawn into the altitude 1, is to the increment of the area, as radius is to the ſine of the angle of the ordinate and abſciſſe, or of the aſymptotes; and at the beginning of the logarithms, the naſcent increment of the natural numbers is to the increment of the logarithms as 1 is to the modulus of the ſyſtem. Hence we eaſily diſcover, that the angle formed by the aſymptotes of the hyperbola, exhibiting Briggs's Syſtem of Logarithms, will be 25° 44′ 25′″; this being the angle whoſe ſine is 0.4342944819, &c. the modulus of this ſyſtem.

Or indeed any one hyperbola, as has been remarked by Mr Baron Maſeres, will expreſs all poſſible ſyſtems of logarithms whatever; namely, if the ſquare or rhombus inſcribed at the vertex, or, which is the ſame thing, any parallelogram inſcribed between the aſymptotes and the curve at any other point, be expounded by the modulus of the ſyſtem; or which is the ſame, by expounding the area, intercepted between two ordinates which are to each other in the ratio of 10 to 1, by the logarithm of that ratio in the propoſed ſyſtem.

As to the firſt remarks on the analogy between logarithms and the hyperbolic ſpaces: it having been ſhewn by Gregory St Vincent in his *Quadratura Circuli et Sectionum Coni*, publiſhed at Antwerp in 1647, that if one aſymptote be divided into parts in geometrical progreſſion, and from the points of diviſion ordinates

dinates be drawn parallel to the other aſymptote, they will divide the ſpace between the aſymptote and curve into equal portions; from hence it was ſhown by Merſennus, that, by taking the continual ſums of thoſe parts, there would be obtained areas in arithmetical progreſſion, adapted to abſciſſes in geometrical progreſſion, and which therefore were analogous to a ſyſtem of logarithms. And the ſame analogy was remarked and illuſtrated ſoon after by Huygens and many others, who ſhow how to ſquare the hyperbolic ſpaces by means of the logarithms. There are likewiſe many other geometrical figures which have properties analogous to logarithms; ſuch as the equiangular ſpiral, the figures of the tangents and ſecants, &c.

§ 5. *Mercator's Method.*

THIS is purely arithmetical, and is founded upon the idea of logarithms already mentioned; *viz.* that they are the meaſures of ratios, and expreſs the number of *ratiunculæ* contained in any ratio into which it may be divided. Having ſhown then that theſe logarithms or numbers of ſmall ratios, or meaſures of ratios, may be all properly repreſented by numbers; and that of 1, or the ratio of equality, the logarithm or meaſure being always 0, the logarithm of 10, or the meaſure of the ratio of 10 to 1, is moſt conveniently repreſented by 1 with any number of cyphers; he then proceeds to ſhow how the meaſures of all other ratios may be found from this laſt ſuppoſition. And he explains the principles by the two following examples.

Firſt, to find the logarithm of 100·5, or to find how many *ratiunculæ* are contained in the ratio of 1005 to 1, the number of *ratiunculæ* in the decuple ratio, or ratio of 10 to 1, being 10,000,000.

The given ratio 100·5 to 1 he firſt divides into its parts; namely, 100·5 to 100, 100 to 10, and 10 to 1; the laſt two of which being decuples, it follows that the characteriſtic will be 2, and it only remains to find how many parts of the next decuple belong to the firſt ratio of 100·5 to 100. Now if each term of this ratio be multiplied by itſelf, the products will be in the duplicate ratio of the firſt terms, or this laſt ratio will contain a double number of parts; and if theſe be multiplied by the firſt terms again, the ratio of the laſt products will contain three times the number of parts, and ſo on; the number of times of the firſt parts contained in the ratio of any like powers of the firſt terms, being always denoted by the exponent of the power. If therefore the firſt terms 100·5 and 100 be continually multiplied till the ſame powers of them have to each other a ratio whoſe meaſure is known; as ſuppoſe the decuple ratio 10 to 1, whoſe meaſure is 10,000,000: then the exponent of that power ſhows what multiple this meaſure 10,000,000 of the decuple ratio is of the required meaſure of the firſt ratio 100.5 to 100; and conſequently dividing 10,000,000 by that exponent, the quotient is the meaſure of the ratio 100.5 to 100 ſought. The operation for finding this he ſets down as here follows; where the ſeveral multiplications are all performed in the contracted way by inverting the figures of the multiplier, and retaining only the firſt number of decimals in each product.

	Power.
100.5000	1
5001	1
1005000	
5025	
1010025	2
5200101	2
1010025	
10100	
20	
5	
1020150	4
0510201	4
1020150	
20403	
102	
51	
1040706	8
6070401	8
1083068	16
8603801	16
1173035	32
5303711	32
1376011	64
1106731	64
1893406	128
6043981	128
3584985	256
5894853	256
12852116	512

This power being greater than the decuple of the like power of 100, which muſt always be 1 with cyphers reſume therefore the 256th power, and multiply it not by itſelf but by the next before it, *viz.* by the 128th, thus,

	Power,
3584985	256
6043981	128
6787831	384
1106731	64
9340130	448
5303711	32
10956299	480

This power again exceeding the ſame power of 100 more than 10 times, he therefore draws the ſame 448th not into the 32d but the next preceeding, thus

	Power,
9340130	448
8603801	16
10115994	464

This being again too much, inſtead of the 16th draw it into the 8th or next preceeding, thus,

	Power.
9340130	448
6070401	8
9720329	456
0510201	4
9916193	460
5200101	2
10015603	462

Which

Which power again exceeds the limit: therefore draw the 460th into the 1ſt, thus,

		Power.
9916193	- - -	460
5001	- - -	1
9965774	- - -	461

Since, therefore, the 462d power of 100.5 is greater, and the 461ſt power is leſs, than the decuple of the ſame power of 100; he finds that the ratio of 100.5 to 100 is contained in the decuple more than 461 times, but leſs than 462 times. Again,

Since the	460	power is	9916193	and the differences
	461		9965774	49581 nearly
	462		10015603	49829 equal;

therefore the proportional part which the exact power, or 10000000, exceeds the next leſs 9965774, will be eaſily and accurately found by the Golden Rule, thus:

The juſt power - - 10000000
and the next leſs - - 9965774
the difference - 34226; then,

As 49829 the dif. between the next leſs and greater,
: To 34226 the dif. between the next leſs and juſt,
: : So is 10000 : to 6868, the decimal parts; and therefore the ratio of 100.5 to 100, is 461·6868 times contained in the decuple or ratio of 10 to 1. Dividing now 1,0000000, the meaſure of the decuple ratio, by 461.6868, the quotient 00216597 is the meaſure of the ratio of 100·5 to 100; which being added to 2, the meaſure of 100 to 1, the ſum 2,00216597 is the meaſure of the ratio of 100·5 to 1, that is, the log. of 100·5 is 2,00216597.

In the ſame manner he next inveſtigates the log. of 99.5, and finds it to be 1,99782307.

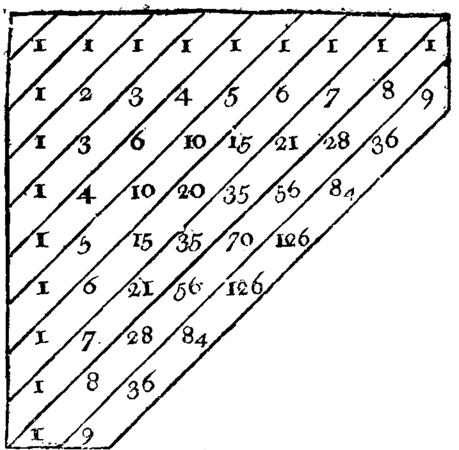
A few obſervations are then added, calculated to generalize the conſideration of ratios, their magnitude and affections. It is here remarked, that he conſiders the magnitude of the ratio between two quantities as the ſame, whether the antecedent be the greater or the leſs of the two terms; ſo the magnitude of the ratio of 8 to 5 is the ſame as of 5 to 8; that is, by the magnitude of the ratio of either to the other is meant the number of *ratiunculæ* between them, which will evidently be the ſame whether the greater or leſs term be the antecedent. And he farther remarks, that of different ratios, when we divide the greater term of each ratio by the leſs, that ratio is of the greater maſs or magnitude which produces the greater quotient, *et vice verſa;* although thoſe quotients are not proportional to the maſſes or magnitudes of the ratios. But when he conſiders the ratio of a greater term to a leſs, or of a leſs to a greater, that is to ſay, the ratio of greater or leſs inequality, as abſtracted from the magnitude of the ratio, he diſtinguiſhes it by the word *affection*, as much as to ſay, greater or leſs affection, ſomething in the manner of poſitive and negative quantities, or ſuch as are affected with the ſigns + and — . . . . . The remainder of this work he delivers in ſeveral propoſitions, as follows:

Prop. 1. In ſubtraction from each other two quantities of the ſame affection, to wit, both poſitive, or both negative; if the remainder be of the ſame affection with the two given, then is the quantity ſubtracted the leſs of the two, or expreſſed by the leſs number; but if the contrary, it is the greater.

Prop. 2. In any continued ratios, as $\frac{a}{a+b}$, $\frac{a+b}{a+2b}$, $\frac{a+2b}{a+3b}$, &c. (by which is meant the ratios of a to $a+b$, $a+b$ to $a+2b$, $a+2b$ to $a+3b$, &c.) of equidifferent terms, the antecedent of each ratio being equal to the conſequent of the next preceding one, and proceeding from leſs terms to greater; the meaſure of each ratio will be expreſſed by a greater quantity than that of the next following; and the ſame through all their orders of differences, namely, the 1ſt, 2d, 3d, &c. differences; but the contrary, when the terms of the ratios decreaſe from greater to leſs.

Prop. 3. In any continued ratios of equidifferent terms, if the 1ſt or leaſt be a, the difference between the 1ſt and 2d b, and c, d, e, &c. the reſpective firſt term of their 2d, 3d, 4th, &c. differences; then ſhall the ſeveral quantities themſelves be as in the annexed ſcheme; where each term is compoſed of the firſt term together with as many of the differences as it is diſtant from the firſt term, and to thoſe differences joining, for coefficients, the numbers in the ſloping or oblique lines contained in the annexed table of figurate numbers; in the ſame manner, he obſerves, as the ſame figurate numbers complete the powers raiſed from a binomial root, as had long before been taught by others. He alſo remarks, that this rule not only gives any one term, but alſo the ſum of any number of ſucceſſive terms from the beginning, making the 2d coefficient the 1ſt, the 3d, the 2d, and ſo on; thus, the ſum of the firſt 5 terms is $5a+10b+10c+5d+e$.

1ſt term - a
2d - $a+b$
3d - $a+2b+c$
4th - $a+3b+3c+d$
5th - $a+4b+6c+4d+e$
&c. &c.



1	1	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9
1	3	6	10	15	21	28	36	
1	4	10	20	35	56	84		
1	5	15	35	70	126			
1	6	21	56	126				
1	7	28	84					
1	8	36						
1	9							

In the 4th *prop.* it is ſhown, that if the terms decreaſe, proceeding from the greater to the leſs, the ſame theorems hold good, by only changing the ſign of every other term, as below.

1ſt term - a
2d - - $a-b$
3d - - $a-2b+c$
4th - - $a-3b+3c-d$
5th - - $a-4b+6c-4d+e$
&c. &c.

Prop. 6th and 7th, treat of the approximate multiplication and diviſion of ratios, or, which is the ſame thing, the finding nearly any powers or any roots of a given fraction, in an eaſy manner. The theorem for raiſing

raiſing any power, when reduced to a ſimpler form, is this, the m power of $\frac{a}{b}$, or $\overline{\frac{a}{o}}\Big|^{m}$ is $= \frac{s \mp md}{s \pm md}$ nearly, where s is $= a + b$, and $d = a \backsim b$, the ſum and difference of the two numbers, and the upper or under ſigns take place according as $\frac{a}{b}$ is a proper or an improper fraction, that is, according as a is leſs or greater than b. And the theorem for extracting the mth root of $\frac{a}{b}$ is $\sqrt[m]{\frac{a}{b}}$ or $\overline{\frac{a}{b}}\Big|^{\frac{1}{m}} = \frac{ms \mp d}{ms \pm d}$ nearly; which latter rule is alſo the ſame as the former, as will be evident by ſubſtituting $\frac{1}{m}$ inſtead of m in the firſt theorem. So that univerſally $\overline{\frac{a}{b}}\Big|^{\frac{m}{n}}$ is $= \frac{ns \mp md}{ns \pm md}$ nearly. Theſe theorems, however, are nearly true only in ſome certain caſes, namely, when $\frac{a}{b}$ and $\frac{m}{n}$ do not differ greatly from unity. And in the 7th *prop.* the author ſhows how to find nearly the error of the theorems.

In the 8th *prop.* it is ſhown, that the meaſures of ratios of equidifferent terms, are nearly reciprocally as the arithmetical means between the terms of each ratio. So of the ratios $\frac{16}{18}$, $\frac{33}{35}$, $\frac{50}{52}$, the mean between the terms of the firſt ratio is 17, of the 2d 34, of the 3d 51, and the meaſures of the ratios are nearly as $\frac{1}{17}$, $\frac{1}{34}$, $\frac{1}{51}$.

From this property he proceeds, in the 9th prop. to find the meaſure of any ratio leſs than $\frac{99\cdot5}{100\cdot5}$, which has an equal difference (1) of terms. In the two examples mentioned near the beginning, our author found the logarithm or meaſure of the ratio, of $\frac{99\cdot5}{100}$, to be $21769\frac{3}{10}$, and that of $\frac{100}{100\cdot5}$, to be $21659\frac{7}{10}$; therefore the ſum 43429 is the logarithm of $\frac{99\cdot5}{100\cdot5}$, or $\frac{99\cdot5}{100} \times \frac{100}{100\cdot5}$; or the logarithm of $\frac{99\cdot5}{100\cdot5}$ is nearer 43430, as found by other more accurate computations. ---Now, to find the logarithm of $\frac{100}{101}$, having the ſame difference of terms (1) with the former; it will be, by prop. 8. as 100.5 (the mean between 101 and 100): 100 (the mean between 99·5 and 100·5) : : 43430 : 43213 the logarithm of $\frac{100}{101}$, or the difference between the logarithms of 100 and 101. But the logarithm of 100 is 2; therefore the logarithm of 101 is 2,0043213.——Again, to find the logarithm of 102, we muſt firſt find the logarithm of $\frac{101}{102}$: the mean between its terms being 101·5, therefore as 101·5 : 100 : : 43430 : 42788 the logarithm of $\frac{101}{102}$ or the difference of the logarithms of 101 and 102. But the logarithm of 101 was found above to be 2,0043213; therefore the logarithm of 102 is 2,0086001.—So that dividing continually 868596 (the double of 434298 the logarithm of $\frac{99\cdot5}{100\cdot5}$ or $\frac{199}{201}$) by each number of the ſeries 201, 203, 205, 207, &c. then add 2 to the 1ſt quotient, to the ſum add the 2nd quotient, and ſo on, adding always the next quotient to the laſt ſum, the ſeveral ſums will be the reſpective logarithms of the numbers in this ſeries, 101, 102, 103, 104, &c.

The next, or prop. 10th, ſhows that of two pair of continued ratios, whoſe terms have equal differences, the difference of the meaſures of the firſt two ratios is to the difference of the meaſures of the other two, as the ſquare of the common term in the two latter is to that in the former, nearly. Thus, in the four ratios $\frac{a}{a+b}$, $\frac{a+b}{a+2b}$, $\frac{a+3b}{a+4b}$, $\frac{a+4b}{a+5b}$, as the meaſ. of $\frac{aa+2ab}{\overline{a+b}\,\big|^{2}}$ (the difference of the firſt two, or the quotient of the two fractions) : the meaſure of $\frac{aa+8ab+15bb}{\overline{a+4b}\,\big|^{2}}$: : $\overline{a+4b}\,\big|^{2}$: $\overline{a+b}\,\big|^{2}$, nearly.

In *prop.* 11. the author ſhows that ſimilar properties take place among two ſets of ratios, conſiſting each of 3 or 4, &c. continued numbers.

Prop. 12. ſhows, that of the powers of numbers in arithmetical progreſſion, the orders of differences which become equal, are the ſecond differences in the ſquares, the 3d differences in the cubes, the 4th differences in the 4th powers, &c. And from hence it is ſhown, how to conſtruct all thoſe powers by the continual addition of their differences: As had been long before more fully explained by Briggs.

In the next, or 13th *prop.* our author explains his compendious method of raiſing the tables of logarithms, ſhowing how to conſtruct the logarithms by addition only, from the properties contained in the 8th, 9th, and 12th propoſitions. For this purpoſe he makes uſe of the quantity $\frac{a}{b-c}$, which by diviſion he reſolves into this infinite ſeries $\frac{a}{b} + \frac{ac}{bb} + \frac{ac^2}{b^3} + \frac{ac^3}{b^4}$, &c. *(in infin.)* Putting then $a = 100$ the arithmetical mean between the terms of the ratio $\frac{99\cdot5}{100\cdot5}$, $b = 100000$, and c ſucceſſively equal to 0·5, 1·5, 2·5, &c. that ſo $b-c$ may be reſpectively equal to 99999·5, 99998·5, 99997·5, &c. the correſponding means between the terms of the ratios $\frac{99999}{100000}$, $\frac{99998}{99999}$, $\frac{99997}{99998}$, &c. it is evident that $\frac{a}{b-c}$ will be the quotient of the 2d term divided by the firſt in the proportions mentioned in the 8th and 9th propoſitions; and when each of theſe quotients are found, it remains then only to multiply them by the conſtant 3d term 43429, or rather 43429·8, of the proportion, to produce the logarithms of the ratios $\frac{99999}{100000}$, $\frac{99998}{99999}$, $\frac{99997}{99998}$, &c. till $\frac{10000}{10001}$; then adding theſe continually to 4 the logarithm of 10000 the leaſt number, or ſubtracting them from 5 the logarithm of the higheſt term 100000, there will reſult the logarithms of all the abſolute numbers from 10000 to 100000. Now when c is $= 0.5$, then

$$\frac{a}{b} = \cdot001,\ \frac{ac}{bb} = \cdot000000005,\ \frac{ac^2}{b^3} = \cdot000000000000025,\ \frac{ac^3}{b^4} = \cdot000000000000000000125,$$

$$\text{\&c.; therefore } \frac{a}{b-c} = \frac{a}{b} + \frac{ac}{bb} + \frac{ac^2}{b^3},\ \text{\&c. is} = \cdot001000005000025000125,$$

In like manner, if $c = 1.5$, then $\frac{a}{b+c}$ will be $= \cdot001000015000225003375$;

and if $c = 2\cdot5$, then $\frac{a}{b-c}$ will be $= \cdot001000025000625015625$,

&c.

Conſtruction of Logarithms.

&c. But inſtead of conſtructing all the values of $\frac{a}{b-c}$ in the uſual way of raiſing the powers, he directs them to be found by addition only, as in the laſt propoſition. Having thus found all the values of $\frac{a}{b-c}$, the author then ſhows, that they may be drawn into the conſtant logarithm 43429 by addition only, by the help of the annexed table of the firſt 9 products of it.

1	43429
2	86858
3	130287
4	173716
5	217145
6	260574
7	304003
8	347432
9	390861

The author then diſtinguiſhes which of the logarithms it may be proper to find in this way, and which from their component parts. Of theſe the logarithms of all even numbers need not be thus computed, being compoſed from the number 2; which cuts off one half of the numbers: neither are thoſe numbers to be computed which end in 5, becauſe 5 is one of their factors; theſe laſt are $\frac{1}{10}$ of the numbers; and the two together $\frac{1}{2}+\frac{1}{10}$ make $\frac{3}{5}$ of the whole: and of the other $\frac{2}{5}$, the $\frac{1}{3}$ of them, or $\frac{2}{15}$ of the whole, are compoſed of 3; and hence $\frac{3}{5}+\frac{2}{15}$, or $\frac{11}{15}$ of the numbers, are made up of ſuch as are compoſed of 2, 3, and 5. As to the other numbers which may be compoſed of 7, of 11, &c.; he recommends to find their logarithms in the general way, the ſame as if they were incompoſites, as it is not worth while to ſeparate them in ſo eaſy a mode of calculation. So that of the 90 chiliads of numbers from 10000 to 100000, only 24 chiliads are to be computed. Neither indeed are all of theſe to be calculated from the foregoing ſeries for $\frac{a}{b-c}$; but only a few of them in that way, and the reſt by the proportion in the 8th propoſition. Thus, having computed the logarithms of 10003 and 10013, omitting 10023 as being diviſible by 3, eſtimate the logarithms of 10033 and 10043, which are the 30th numbers from 10003 and 10013; and again, omitting 10053, a multiple of 3, find the logarithms of 10063 and 10073. Then by prop. 8

As 10048, the arithmetical mean between 10033 and 10063,
to 10018, the arithmetical mean between 10003 and 10033,
ſo 13006, the difference between the logarithms of 10003 and 10033,
to 12967, the difference between the logarithms of 10033 and 10063;

$$\text{That is, 1ſt As} \left\{\begin{matrix}10048\\10078\\10108\end{matrix}\right\} : 10018 :: 13006 : \left\{\begin{matrix}12967\\\&\text{c.}\end{matrix}\right.$$

$$\text{Again, As} \left\{\begin{matrix}10058\\10088\\10118\end{matrix}\right\} : 10028 :: 12992 : \left\{\begin{matrix}12953\\\&\text{c.}\end{matrix}\right.$$

$$\text{And 3dly, as} \left\{\begin{matrix}10068\\10098\\\&\text{c.}\end{matrix}\right\} : 10038 :: 12979 : \left\{\begin{matrix}12940\\\&\text{c.}\end{matrix}\right.$$

And with this our author concludes his compendium for conſtructing the tables of logarithms.

§ 6. *Gregory's Method.*

This is founded upon an analogy between a ſcale of logarithmic tangents and Wright's protraction of the nautical meridian line conſiſting of the ſums of the ſecants. It is not known by whom this diſcovery was made; but, about 1645, it was publiſhed by Mr Henry Bond, who mentions this property in Norwood's Epitome of Navigation. The mathematical demonſtration of it was firſt inveſtigated by Mercator; who, with a view to make ſome advantage of his diſcovery, offered, in the Philoſophical Tranſactions for June 4th 1666, to lay a wager with any one concerning it; but this propoſal not being accepted, the demonſtration was not publiſhed. Other mathematicians, however, ſoon found out the myſtery; and in two years after, Dr Gregory publiſhed a demonſtration, and from this and other ſimilar properties he ſhowed a method of computing the logarithmic ſines and tangents by means of an infinite ſeries. Several of theſe were invented by him, and the method of applying them laid down by himſelf and others; but Mr Hutton thinks that a ſhorter and better method than any they propoſed might have been found by computing, by means of the ſeries, only a few logarithms of ſmall ratios, in which the terms of the ſeries would have decreaſed by the powers of 10 or ſome greater number, the numerators of all the terms being unity, and their denominators the powers of 10 or ſome greater number, and then employing theſe few logarithms, ſo computed, to the finding of the logarithms of other and greater ratios by the eaſy operations of mere addition and ſubtraction. This might have been done for the logs. of the ratios of the firſt ten numbers, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, to 1, in the following manner, communicated by Mr Baron Maſeres.—In the firſt place the logarithm of the ratio of 10 to 9, or of 1 to $\frac{9}{10}$, or of 1 to $1-\frac{1}{10}$, is equal to the ſeries $\frac{1}{10}+\frac{1}{2\times100}+\frac{1}{3\times1000}+\frac{1}{4\times10000}+\frac{1}{5\times100000}$ &c. In like manner are eaſily found the logarithms of the ratios of 11 to 10; and then by the ſame ſeries thoſe of 121 to 120, and of 81 to 80, and of 2401 to 2400; in all which caſes the ſeries would converge ſtill faſter than in the two firſt caſes. We may then proceed by mere addition and ſubtraction of logarithms, as follows.

$\text{Log.}\ \frac{11}{9}=\text{L.}\ \frac{11}{10}+\text{L.}\ \frac{10}{9}$,
$\text{L.}\ \frac{121}{81}=2\text{L.}\ \frac{11}{9}$,
$\text{L.}\ \frac{121}{80}=\text{L.}\ \frac{121}{81}+\text{L.}\ \frac{81}{80}$,
$\text{L.}\ \frac{120}{80}=\text{L.}\ \frac{121}{80}-\text{L.}\ \frac{121}{120}$

$\text{L.}\ \frac{120}{80}=\text{L.}\ \frac{3}{2}$,
$\text{L.}\ \frac{9}{4}=2\text{L.}\ \frac{3}{2}$,
$\text{L.}\ \frac{10}{4}=\text{L.}\ \frac{10}{9}+\text{L.}\ \frac{9}{4}$,
$\text{L.}\ \frac{18}{16}=2\text{L.}\ \frac{9}{4}$,

$\text{L.}\ \frac{80}{16}=\text{L.}\ \frac{81}{16}-\text{L.}\ \frac{81}{80}$
$\text{L.}\ \frac{5}{1}=\text{L.}\ \frac{80}{16}$,
$\text{L.}\ \frac{5}{2}=\text{L.}\ \frac{10}{4}$,
$\text{L.}\ \frac{2}{1}=\text{L.}\ \frac{5}{1}-\text{L.}\ \frac{5}{2}$.

Having thus got the logarithm of the ratio of 2 to 1, or, in common language, the logarithm of 2, the logarithms of all ſorts of even numbers may be derived from thoſe of the odd numbers which are their coefficients with 2 or its powers. We may then proceed as follows.

$\text{L. } 4 = 2\text{L.}2,$
$\text{L. } 10 = \text{L. }\frac{10}{4} + \text{L.}4,$
$\text{L. } 9 = \text{L. }\frac{9}{4} + \text{L.}4,$
$\text{L. } 3 = \frac{1}{2}\text{L.}9.$

$\text{L. } 100 = 2\text{L. }10,$
$\text{L. } 8 = 3\text{L. }2,$
$\text{L. } 24 = \text{L. }8 + \text{L. }3,$
$\text{L. } 2400 = \text{L.}100 + \text{L.}24.$

$\text{L. } 2401 = \text{L. }\frac{2401}{2400} + \text{L. }2400,$
$\text{L. } 7 = \frac{1}{4}\text{L. }2401,$
$\text{L. } 11 = \text{L. }\frac{11}{9} + \text{L.}9.$
$\text{L. } 6 = \text{L. }2 + \text{L. }3.$

Thus we have got the logarithms of 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11. And this is upon the whole, perhaps, the beſt method of computing logarithms that can be taken.—This method of computing logarithms is very nearly the ſame with that of Sir Iſaac Newton in his ſecond letter to Mr Oldenburg, dated October 1676.

§ 7. *Conſtruction of Logarithms by Fluxions.*

From the definition and deſcription of logarithms given by Napier, and of which we have already taken notice, it appears that the fluxion of his, or the hyperbolic logarithm of any number, is a fourth proportional to that number, its logarithm and unity; or, which is the ſame, that it is equal to the fluxion of the number divided by the number: For the deſcription ſhows that $z1 : za$ or $1 : : \dot{z}1$ the fluxion of $z1 : \dot{z}a$, which therefore is $= \frac{\dot{z}1}{z1}$; but $\dot{z}a$ is alſo equal to the fluxion of the logarithm A, &c. by the deſcription; therefore the fluxion of the logarithm is equal to $\frac{\dot{z}1}{z1}$, the fluxion of the quantity divided by the quantity itſelf. The ſame thing appears again at art. 2. of that little piece in the appendix to his *Conſtructio Logarithmorum*, intitled *Habitudines Logarithmorum & ſuorum naturalium numerorum invicem*; where he obſerves, that as any greater quantity is to a leſs, ſo is the velocity of the increment or decrement of the logarithms at the place of the leſs quantity to that at the greater. Now this velocity of the increment or decrement of the logarithms being the ſame thing as their fluxions, that proportion is this $x : a : :$ flux. log. a : flux. log. x: hence if a be $=1$, as at the beginning of the table of numbers, where the fluxion of the logs. is the index or characteriſtic c, which is alſo one in Napier's or the hyperbolic logarithms, and 43429, &c. in Briggs's, the ſame proportion becomes $x : 1 : : c :$ flux. log. x; but the conſtant fluxion of the numbers is alſo 1, and therefore that proportion is alſo this $x : \dot{x} : : c : \frac{c\dot{x}}{x} =$ the fluxion of the logarithm of x: and in the hyperbolic logarithms, where c is $= 1$, it becomes $\frac{\dot{x}}{x} =$ the fluxion of Napier's or the hyberbolic logarithm of x. This ſame property has alſo been noticed by many other authors ſince Napier's time. And the ſame or a ſimilar property is evidently true in all the ſyſtems of logarithms whatever, namely, that the modulus of the ſyſtem is to any number as the fluxion of its logarithm is to the fluxion of the number.

Now from this property, by means of the doctrine of fluxions, are derived other ways for making logarithms, which have been illuſtrated by many writers on this branch; as Craig, Jo. Bernoulli, and almoſt all the writers on fluxions. And this method chiefly conſiſts in expanding the reciprocal of the given quantity in an infinite ſeries, then multiplying each term by the fluxion of the ſaid quantity, and laſtly taking the fluents of the terms; by which there ariſes an infinite ſeries of terms for the logarithm ſought. So, to find the logarithm of any number N, put any compound quantity for N, as ſuppoſe $\frac{n+x}{n}$; then the flux. of the log. or $\frac{\dot{N}}{N}$ being $\frac{\dot{x}}{n+x} = \frac{\dot{x}}{n} - \frac{\dot{x}x}{nn} + \frac{x^2\dot{x}}{n^3} - \frac{x^3\dot{x}}{n^4}$, &c. the fluents give log. of N or log. of $\frac{n+x}{n} = \frac{x}{n} - \frac{x^2}{2n^2} + \frac{x^3}{3n^3} - \frac{x^4}{4n^4}$, &c. And writing $-x$ for x gives log. $\frac{n-x}{n} = -\frac{x}{n} - \frac{x^2}{2n^2} - \frac{x^3}{3n^3} - \frac{x^4}{4n^4}$, &c. Alſo, becauſe $\frac{n}{n \pm x} - 1 = \div \frac{n+x}{n}$, or log. $\frac{n}{n \mp x} = 0 - \text{log. } \frac{n \pm x}{n}$, we have log. $\frac{n}{n+x} = -\frac{x}{n} + \frac{x^2}{2n^2} - \frac{x^3}{3n^3} + \frac{x^4}{4n^4}$, &c. and log. $\frac{n}{n-x} = +\frac{x}{n} + \frac{x^2}{2n^2} + \frac{x^3}{3n^3} + \frac{x^4}{4n^4}$, &c.

And by adding and ſubtracting any of theſe ſeries to or from one another, and multiplying or dividing their correſponding numbers, various other ſeries for logarithms may be found, converging much quicker than theſe do.

In like manner, by aſſuming quantities otherwiſe compounded for the value of N, various other forms of logarithmic ſeries may be found by the ſame means.

§ 8. *Mr Long's Method.*

This method was publiſhed in the 339th number of the Philoſophical Tranſactions; and is performed by means of a ſmall table containing eight claſſes of logarithms, as follows.

Lo.	Nat. Numb.	Log.	Nat. Numb.	Log.	Nat. Numb	Log.	Nat. Numb.
,9	7,943282347	,009	1,020939484	,00009	1,000207254	,0000009	1,000002072
,8	6,309573445	8	1,018591388	8	1,000184224	8	1,000001842
,7	5,011872336	7	1,016248694	7	1,000161194	7	1,000001611
,6	3,981071706	6	1,013911386	6	1,000138165	6	1,000001381
,5	3,162277660	5	1,011579454	5	1,000115136	5	1,000001151
,4	2,511886432	4	1,009252886	4	1,000092106	4	1,000000921
,3	1,995262315	3	1,006931669	3	1,000069080	3	1,000000690
,2	1,584893193	2	1,004615794	2	1,000046053	2	1,000000460
,1	1,258925412	1	1,002305238	1	1,000023026	1	1,000000230
,09	1,230268771	,0009	1,002074475	,000009	1,000020724	,00000009	1,000000207
8	1,202264435	8	1,001843766	8	1,000018421	8	1,000000184
7	1,174897555	7	1,001613109	7	1,000016118	7	1,000000161
6	1,148153621	6	1,001382506	6	1,000013816	6	1,000000138
5	1,122018454	5	1,001151956	5	1,000011513	5	1,000000115
4	1,096478196	4	1,000921459	4	1,000009210	4	1,000000092
3	1,071519305	3	1,000691015	3	1,000006908	3	1,000000069
2	1,047128548	2	1,000460623	2	1,000004605	2	1,000000046
1	1,023292992	1	1,000230285	1	1,000002302	1	1,000000023

Here, becauſe the logarithms in each claſs are the continual multiples 1, 2, 3, &c. of the loweſt, it is evident that the natural numbers are ſo many ſcales of geometrical proportionals, the loweſt being the common ratio, or the aſcending numbers are the 1, 2, 3, &c. powers of the loweſt, as expreſſed by the figures 1, 2, 3, &c. of their correſponding logarithms. Alſo the laſt number in the firſt, ſecond, third, &c. claſs, is the 10th, 100th, 1000th, &c. root of 10; and any number in any claſs is the 10th power of the correſponding number in the next following claſs.

To find the logarithm of any number, as ſuppoſe of 2000, by this table: Look in the firſt claſs for the number next leſs than the firſt figure 2, and it is 1,995262315, againſt which is 3 for the firſt figure of the logarithm ſought. Again, dividing 2, the number propoſed, by 1,995262315, the number found in the table, the quotient is 1,0023744467; which being looked for in the ſecond claſs of the table, and finding neither its equal nor a leſs, 0 is therefore to be taken for the ſecond figure of the logarithm; and the ſame quotient 1,0023744467, being looked for in the third claſs, the next leſs is there found to be 1,002305238, againſt which is 1 for the third figure of the logarithm; and dividing the quotient 1,0023744467 by the ſaid next leſs numb. 1,002305238, the new quotient is 1,000069070; which being ſought in the fourth claſs gives 0, but ſought in the fifth claſs gives 2, which are the fourth and fifth figures of the logarithm ſought: again, dividing the laſt quotient by 1,000046053, the next leſs number in the table, the quotient is 1,000023015, which gives 9 in the 6th claſs for the 6th figure of the logarithm ſought: and again dividing the laſt quotient by 1,000020724, the next leſs number, the quotient is 1,000002291, the next leſs than which in the 7th claſs gives 9 for the 7th figure of the logarithm: and dividing the laſt quotient by 1,000002072, the quotient is 1,000000219, which gives 9 in the 8th claſs for the 8th figure of the logarithm: and again the laſt quotient 1,000000219 being divided by 1,000000207 the next leſs, the quotient 1,000000012 gives 5 in the ſame 8th claſs, when one figure is cut off, for the 9th figure of the logarithm ſought. All which figures collected together give 3,301029995 for Briggs's logarithm of 2000, the index 3 being ſupplied; which logarithm is true in the laſt figure.

To find the number anſwering to any given logarithm, as ſuppoſe to 3,3010300; omitting the characteriſtic, againſt the other figures 3, 0, 1, 0, 3, 0, 0, as in the firſt column in the margin, are the ſeveral numbers as in the ſecond column, found from their reſpective 1ſt, 2d, 3d, &c. claſſes; the effective numbers of which multiplied continually together, the laſt product is 2,0000000019966, which, becauſe the characteriſtic is three, gives 2000,000019966 or 2000 only for the required number anſwering to the given logarithm.

3	1,995262315
0	0
1	1,002305238
0	0
3	1,000069080
0	0
0	0

§ 9. *Mr Hutton's Practical Rule for the Conſtruction of Logarithms.*

The methods laid down in the above ſections are abundantly ſufficient to ſhow the various principles upon which logarithms may be conſtructed; though there are ſtill a variety of others which our limits will not admit of our inſerting: The following rule is added from Mr Hutton's Treatiſe on the ſubject, for the ſake of thoſe who do not chooſe to enter deeply into theſe inveſtigations.

Call z the ſum of any number whoſe logarithm is ſought, and the number next leſs by unity; divide ·8685889638, &c. (or $2 \div 2.3025$, &c.) by z, and reſerve the quotient; divide the reſerved quotient by the ſquare of z, and reſerve this quotient; divide this laſt quotient alſo by the ſquare of z, and again reſerve this quotient; and thus proceed continually, dividing this laſt quotient by the ſquare of z as long as diviſion can be made. Then write theſe quotients orderly under one another, the firſt uppermoſt, and divide them reſpectively by the uneven numbers 1, 3, 5, 7, 9, 11, &c. as long as diviſion can be made; that is, divide the 1ſt reſerved quotient by 1, the 2d by 3, the 3d by 5, the 4th by 7, &c. Add all theſe laſt quotients together, and the ſum will be the logarithm of $b \div a$; and therefore to this logarithm add alſo the logarithm

Conſtruction of Logarithms.

garithm of *a* the next leſs number, and the ſum will be the required logarithm of *b* the number propoſed.

Ex. 1. *To find the Log. of* 2.—Here the next leſs number is 1, and 2+1=3=*z*, whoſe ſquare is 9. Then,

3)	·868588964	1)	·289529654(	·289529654
9)	·289529654	3)	32169962(	10723321
9)	32169962	5)	3574440(	714888
9)	3574440	7)	397160(	56737
9)	397160	9)	44129(	4903
9)	44129	11)	4903(	446
9)	4903	13)	545(	42
9)	541	15)	61(	4
9)	61			
			Log. $\frac{2}{1}$ -	·301029995
			Add L. 1 -	·000000000
			Log. of 2 -	·301029995

Ex. 2. *To find the Log. of* 3.—Here the next leſs number is 2, and 2+3=5=*z*, whoſe ſquare is 25, to divide by which always multiply by ·04. Then,

5)	·868588964	1)	·173717793(	·173717793
25)	·173717793	3)	6948712(	2316237
25)	6948712	5)	277948(	55590
25)	277948	7)	11118(	1588
25)	11118	9)	448(	50
25)	445	11)	18(	2
	18			
			L. $\frac{3}{2}$ - -	·176091260
			L. 2 add -	·301029995
			L. 3 -	·477121255

Then becauſe the ſum of the logarithms of numbers gives the logarithm of their product, and the difference of the logarithms gives the logarithm of the quotient of the numbers, from the above two logarithms and the logarithm of 10, which is 1, we may raiſe a great many logarithms, thus:

Ex. 3. Becauſe 2×2=4, therefore

to L. 2	- -	·301029995$\frac{2}{3}$
add L. 2.	- -	·301029995$\frac{2}{3}$
ſum is L. 4	- -	·602059991$\frac{1}{3}$

Ex. 4. Becauſe 2×3=6, therefore

to L. 2	- -	·301029995
add L. 3	- -	·477121255
ſum is L. 6	- -	·778151250

Ex. 5. Becauſe $2^3=8$, therefore

L. 2.	- -	·301029995$\frac{2}{3}$
mult. by	- -	3
give L. 8	- -	·903089987

Ex 6. Becauſe $3^2=9$, therefore

L. 3	- -	·477121254$\frac{7}{10}$
mult. by	- -	2
gives L. 9.	-	·954242509

Conſtruction of Logarithms.

Ex. 7. Becauſe $\frac{10}{2}=5$, therefore

from L. 10	-	1·000000000
take L. 2	-	·301029995$\frac{1}{2}$
leaves L. 5	-	·698970004$\frac{1}{2}$

Ex. 8. Becauſe 12=3×4, therefore

to L. 3	- -	·477121255
add L. 4	-	·602059991
gives L. 12	-	1.079181246

And thus by computing, by the general rule, the logarithms of the other prime numbers 7, 11, 13, 17, 19, 23, &c. : and then uſing compoſition and diviſion, we may eaſily find as many logarithms as we pleaſe, or may ſpeedily examine any logarithm in the table.

§ 10. *Mr Thomas Atkinſon of Baliſhannon's Method.*

IN any ſeries of numbers in a geometrical progreſſion, beginning from unity, as in the margin, the ſeries is compoſed of a ſet of continued proportionals, of which the member ſtanding neareſt to unity is the common ratio or rate of the proportion. If over or under theſe another ſeries is placed, as in the example, of numbers in an arithmetical progreſſion, beginning with nought, and whoſe common difference is unity, the members of this ſeries are called *indexes;* for they ſerve to ſhow how many ſucceſſive multiplications have been made with the common rate to produce that member of the geometrical progreſſion over which each of theſe indexes does ſeverally ſtand.

0	1	2	3
1	10	100	100

This theory may be conſidered in another light: If the ſquare root of 10 (that is of the common rate) is found, it is a mean proportional between 1 and 10, and becomes a new common rate for a new ſet of continued proportionals, as in the margin. And if the half of unity, which in the former caſe was the additional difference of the arithmetical progreſſion, is made the additional difference of this new ſeries, and noted as in the example, a new combination is formed of two ſerieſes agreeing with the firſt in theſe remarkable properties, viz. If any two members of the geometrical progreſſion are multiplied together, the ſum of their correſponding indexes will become the index of their product; and converſely, if any of them is divided by any other, the difference of their indexes will be found to be the index of the quotient. This theory is indefinite; and repeated extractions may be made with any propoſed number of decimals, and biſection made of the correſponding indexes, until one has no more number to work with; and each of the mean proportionals thus found between 1 and 10, will be found a member of every new geometrical progreſſion formed by every ſmaller root; and conſequently all the roots thus found, together with their correſponding indexes, have, in caſes of multiplication or diviſion, the ſame connection as has been juſt deſcribed.

0	·5	1	1.5	2	25
1	3.16	10	31.6	100	316.

Let thoſe ſucceſſive roots be found, and noted in the form of a table, and, in another column, let the correſponding indexes found by theſe directions be regularly

larly noted, each oppoſite to its own roots. Theſe indexes are commonly known by the denomination of *logarithms*; the roots themſelves may be called *natural numbers*.

Theſe roots are compoſed of natural numbers ſeldom or never wanted; but from them the logarithms of ſuch as are of general uſe may be thus found.

Suppoſe 2 the propoſed number, one muſt examine the table of roots; there he will find 3.16, &c. &c. the neareſt to 2 of thoſe which are greater; and 1.778, &c. &c. alſo neareſt to it of thoſe which are leſs. He may make a diviſion at his pleaſure, either $\frac{3.16}{2}$ or $\frac{2}{1.77}$; yet let the choice fall on what will yield the ſmalleſt quotient, and let the circumſtances of the calculation be noted, as in the margin, for future direction. Here $\frac{2}{1.77}=1.1246$. With this quotient let the table be applied to as before, and 1.1246, &c. will be found to be between 1.154, &c. &c. and 1.074, &c. &c. and diviſion to be made as in the example. In this manner one is to proceed with each ſucceſſive quotient, till at length he has one in which the number of the initial decimal noughts is equal at leaſt, if not greater than that of the ſignificant figures. Here the work of diviſion may be diſcontinued; and as it will rarely happen, that one will not have an additional initial nought for every diviſion, the number cannot be great in calculations of a moderate extent. Having at laſt found a quotient ſuch as was deſcribed, and ſuppoſing the number of decimals to be 10, one may readily find the logm. of that quotient thus:—Suppoſe the quotient 1.0000057968; he is to look into the table of roots for thoſe noted with 5 initial decimal noughts, and from any one of theſe and its correſponding logm. ſtate thus:

$\frac{2}{1.77}=1.1246$,&c. &c.
$\frac{1.154}{1.124}=.02$, &c. &c.

.0000087837, . . .0000038147 its logm. . . . . .0000057968 of the quotient.
.0000025175, its logm.

Thus knowing that 0.0000025175, or ſuch like, is the logm. of the laſt quotient, one may have that of 2, if he will but call to mind the following circumſtances.

In every caſe of diviſion, if he has logarithms of quotient and diviſor, he has alſo that of the dividend, by adding the two firſt together: if he has the logarithm of the dividend, and that of either the diviſor or quotient, he may find that of the other; for he has only to ſubtract what he knows from the logarithm of the dividend, the remainder is what he wants: and laſtly, that in every diviſion he made, he took one number from the table of roots whoſe logarithm is known, being noted in the table, and which he made uſe of as his direction either as a dividend or a diviſor: From theſe circumſtances, one may, by the help of the logarithm juſt found, diſcover the logarithm of that number of the laſt diviſion, whether it be dividend or diviſor, which was the quotient of the preceding diviſion; and thus, tracing his own work backwards by his notes from quotient to quotient, be they ever ſo few or ever ſo many, he will come at laſt by addition and ſubtraction to the logarithm of the propoſed number.

By this method, the logarithm of any number within the compaſs of the table of roots may be found: if a greater is propoſed, ſuppoſe 9495, it muſt be made 9.495, and its logarithm found; then it muſt be reſtored to the propoſed form, and have a proper index noted before the decimals juſt found. How to do this is too well known to have occaſion to mention it here.

The reaſon for finding the logarithm of the laſt quotient by the common proportion is this: He who has made a table of roots, will find, by inſpection only, that as initial noughts come into the decimal parts of the roots, the ſignificant figures juſt immediately following them do aſſume the form of a geometrical progreſſion, deſcending, whoſe common rate or diviſor is two, as is juſt the caſe with the whole of the decimals of the correſponding logarithms; and that the number of the ſignificant figures endued with this property is generally equal to that of the initial noughts: ſo far as this, and no farther, the common proportion will hold between the ſignificant figures of the decimals in the roots and the ſame number of places in the logarithms; and for this reaſon it was needful to continue the ſucceſſive diviſions till a quotient was found ſo circumſtanced, that its logarithm could be found by the proportion.

The ſame gentleman hath alſo favoured us with the following new method

Of extracting Roots of Fractions by LOGARITHMS.

The eaſieſt way to explain this, is firſt to give an example of involving ſuch numbers.

—3.301029995664 the logarithm of the fraction given.
7 the power to which it is to be raiſed.

—19.107209969648 the logarithm of the anſwer.

This differs from the like work in whole numbers only in this, that, in multiplying the decimals, one has at laſt 2 to be carried from them to the whole numbers; this is to be conſidered as +2, then—3×7=—21, and — 21 + 2=— 19 to be noted the index of the anſwer. Extraction of the roots is only the converſe of this. Suppoſe —19.107209969648 given, to find that root whoſe exponent number is 7. As 7 is the exponent number here, one may in his mind multiply it by 2 for a trial, as in common diviſion; but the product=14 being leſs than 19, muſt be rejected; then he may try it with 3, this yields 21 for a product. This 3 muſt be noted with a negative ſign for the index of the new logarithm. Then, on comparing 19 with 21, the difference is

—19.107209969648
—3.301029995664

Explanation of the Table.

2. This 2 muſt be carried as 20 to the decimals, and one muſt from that carry on the diviſion of the decimals with 7 for a diviſor, as is uſually done in other caſes.

Explanation of the Table.

Another Examfle.

Suppoſe —1.4771212545 given, to extract the root of its 5th power.
—1.8954252109 the logarithm of the root.

For 5, the exponent of the root ×1 is greater than the index of the given logarithm, and 4 is the remainder. Then —1 becomes the index of the logarithm of the root; and 4= the overplus, is to be carried as 40 to the decimals; and from that, diviſion is to be made with 5 as a diviſor for the reſt of the work.

Sect. III. *Explanation and Uſe of the Table, with a general Account of the various Sciences to which Logarithms may be applied.*

§ 1. *To find by the table the Logarithm of any number.*

If the number be under 100, it is eaſily found in the firſt diviſion at the head of the firſt page; if it be betwixt 100 and 1000, over againſt the number in the firſt column of the following pages, in the next column under 0 will be found the logarithm required. If the number be betwixt 1000 and 10000, the firſt three figures of the number are to be found in the column marked N° and the fourth figure at the top, and in the column under it, lineally againſt the firſt three figures, will be found the logarithm required, changing the index 2 into 3. The column marked Diff. and ſhowing the common difference by which each of theſe columns increaſes, ſerves to find the logarithms of numbers beyond 10000. Thus,

To find the logarithm for a number greater than any in the common canon, but leſs than 10000000.—Cut off four figures on the left of the given number, and ſeek the logarithm in the table; add as many units to the index as there are figures remaining on the right; ſubtract the logarithm found from the next following it in the table; then, as the difference of numbers in the canon is to the tabular diſtance of the logarithms anſwering to them, ſo are the remaining figures of the given number to the logarithmic difference; which if it be added to the logarithm before found, the ſum will be the logarithm required. Suppoſe v. gr. the logarithm of the number 92375 required. Cut off the four figures 9237, and to the characteriſtic of the logarithm correſponding to them, add an unit; then,

From the logarith. of the numb. 9238=3.965578
Subtract logarith. numb. ———9237=3.965531

Remains tabular difference 47
Then 10 : 47 : : 5 : 23
Now to the logarithm ——————4.965531
Add the difference found——————23
The ſum is the logarithm required.—4.965554

Or more briefly; find the logarithm of the firſt four figures as before; then multiply the common difference which ſtands againſt it by the remaining figures of the given number; from the product, cut off as many figures at the right hand as you multiplied by, and add the remainder to the logarithm before found, fitting it with a proper index. Thus 47×5=235; cut off 5 and add 23.

To find the logarithm of a fraction.—Subtract the logarithm of the numerator from that of the denominator, and to the remainder prefix the ſign of ſubtraction. Thus ſuppoſe it required to find the logarithm of the fraction $\frac{3}{7}$,

Logarithm of 7 = 0.845098
Logarithm of 3 = 0.477121

Logarithm of $\frac{3}{7}$ =—0.367977

The reaſon of the rule is, that a fraction being the quotient of the numerator divided by the denominator, its logarithm muſt be the difference of the logarithms of thoſe two; ſo that the numerator being ſubtracted from the denominator, the difference becomes negative. Stifelius obſerved, that the logarithms of a proper fraction muſt always be negative, if that of unity be 0; which is evident, a fraction being leſs than one.

Or, the logarithm of the denominator, though greater than that of the numerator, as in the caſe of a proper fraction, may be ſubtracted from it, regard being had to the ſign of the index, which alone in that caſe is negative. Thus,

Log. of 3 = 0.477121
Log. of 7 = 0.845098

Log. of $\frac{3}{7}$ = 1.632023 which produces the ſame effect in any operation as that before hand, viz. —0.367977, this being to be ſubtracted, and the other to be added.

Or, again, the fraction may be reduced to a decimal, and its logarithm found; which differs from that of a whole number only in the index, which is to be negative.

For an improper fraction v. gr. $\frac{9}{5}$, its numerator being greater than its denominator, its logarithm is had by ſubtracting the logarithm of the latter from that of the former.

The logarithm of 9=0.9542425
Logarithm of 5=0.6989700

Logarithm $\frac{9}{5}$=0.2552725

In the ſame manner may a logarithm of a mixt number, as $3\frac{2}{7}$, be found, it being firſt reduced into an improper fraction $\frac{32}{7}$.

Or, this improper fraction may be reduced to a mixed number, whoſe logarithm muſt be found as if it were wholly integral, and its index taken according to the integral part. We ſhall here obſerve, that the logarithms of whole numbers are added, ſubtracted, &c. according to the rules of theſe operations in decimal arithmetic; but with regard to the management of logarithms with negative indices, the ſame rules are to be obſerved as thoſe given in algebra for like and unlike ſigns.

In addition, all the figures except the index, are reckoned poſitive, and therefore the figure to be carried to the index from the other part of the logarithm takes away ſo much from the negative index. Thus $1.8683326+\overline{3}.698972=\overline{1}.562298$. In ſubtraction, if either one or both of the logarithms have negative indices, you muſt change the ſign of the index of the

ſub-

Explanation of the Table, &c.

ſubtrahend, after you have carried to it what may ariſe from the decimal part, and then add the indices: thus $\bar{1}.562298$—1.863326=3.698972. In multiplication, what is carried from the product of the other parts of the logarithms muſt be ſubtracted from the product of the indices: thus $\bar{2}.477121 \times 5 = \bar{8}.385605$. In diviſion, if the diviſor will exactly meaſure the index, proceed as in common arithmetic; *e. g.* $\bar{4}.924782 \div 2 = \bar{2}.462391$. But if the diviſor will not exactly meaſure the index, add units to the index, till you can exactly divide it, and carry theſe units to the next number: *e. g.* $\bar{8}.385605 \div 5 = \bar{2}.477121$.

To find the number correſpondimg to any given logarithm.—If the logarithm be within the limits of the table, *i. e.* if its index does not exceed 3, then neglecting the index, look down in the column of logarithms under 0, for the two or three firſt figures of your given logarithm; and if you exactly find all the figures of the given logarithm in that column, you have the number correſponding at the left hand: But if you do not find your logarithm exactly in the column under 0, you muſt run through the other columns till you find it exactly, or till you obtain the next leaſt logarithm; and in the column of numbers lineally againſt it, you have the firſt 3 figures of the number ſought, to which join the figure over the column, where your logarithm or its next leaſt was found, and you have the correſponding number, *e. gr.* the number anſwering to the logarithm 3.544812 is 3506.

If the index of this logarithm had been 1, then the two laſt figures of the number would have been decimal; with the index 0, its correſponding number would have been 3.506; with $\bar{1}$, .3506; with $\bar{2}$, .03506, &c.

If the logarithm cannot be found exactly, take the next leaſt, and make the difference between the given logarithm and the next leaſt the numerator of a fraction whoſe denominator ſhall be the common difference, and add the fraction to the number found in the table.

To find the number correſponding to a logarithm greater than any in the table,—Firſt, from the given logarithm, ſubtract the logarithm of 10, or 100, or 1000, or 10,000, till you have a logarithm that will come within the compaſs of the table; find the number correſponding to this, and multiply it by 10, or 100, or 1000, or 10,000, the product is the number required.

Suppoſe, for inſtance, the number correſponding to the logarithm 7.7589982 be required: ſubtract the logarithm of the number 10,000, which is 4.0000000, from 7.589982; the remainder is 3.7589982, the number correſponding to which is 5741 $\frac{11}{100}$: this multiplied by 10,000, the product is 57411100, the number required.

Otherwiſe ſeek the decimal member of the logarithm, in the table and if you can find it exactly, you have the four firſt figures of the number in the table, to which affix as many ciphers as the given index exceeds 3, and it is the number required. But if you cannot find the four firſt figures of the correſponding number; then take the difference betwixt the given logarithm and the next leaſt, and annex to it as many ciphers as the index exceeds 3; then divide by the common difference, and affix the quotient to the four firſt figures, and you have the number required.

Explanation of the Table, &c.

To find the number correſponding to a negative logarithm. To the given negative logarithm add the laſt logarithm of the table, or that of the number 10000; *i. e.* ſubtract the firſt from the ſecond, and find the number correſponding to the remainder; this will be the numerator of the fraction, whoſe denominator will be 10000; *v. gr.* ſuppoſe it to be required to find the fraction correſponding to the negative logarithm

0.3679767, ſubtract this from
4.0000000

The remainder is —— 3.6320233, the number correſponding to which is 4285$\frac{71}{100}$, the fraction ſought therefore is $\frac{4785}{10000000}$. The reaſon of the rule is, that as a fraction is the quotient, ariſing on the diviſion of the numerator by the denominator, unity will be to the fraction as the denominator to the numerator; but as unity is to the fraction correſponding to the given negative logarithm, ſo is 10000 to the number correſponding to the remainder: therefore, if 10000 be taken for the denominator, the number will be the numerator of the fraction required.

The negative logarithm —0.367977 is equal to the logarithm $\bar{1}.632023$, and the number anſwering to it, found in the manner already directed, will be .4285$\frac{72}{101}$.

The ſines, tangents, &c. of any arch are eaſily found by ſeeking the degree at the top, if the arch be leſs than 45°, and the minutes at the ſide, beginning from the top, and by ſeeking the degree, &c. at the bottom, if the arch is greater than 45°. If a given logarithmic ſine or tangent falls between thoſe in the tables, then the correſponding degrees and minutes may be reckoned $\frac{1}{4}$, $\frac{1}{3}$, or $\frac{1}{2}$, &c. minutes more than thoſe belonging to the neareſt leſs logarithm in the tables, according as its difference from the given one is $\frac{1}{4}$, or $\frac{1}{3}$, or $\frac{1}{2}$, &c. of the difference between the logarithm next greater and next leſs than the given log.

§ 2. *Of the various Sciences to which Logarithms may be applied.*

As theſe artificial numbers conſtitute a new ſpecies of arithmetic capable of performing every thing which can be done in the old way, it is plain that its uſe muſt be equally extenſive, and that in every ſcience in which common arithmetic can be uſeful, the logarithmical arithmetic muſt be much more ſo, by reaſon of its being more eaſily performed. Though the general principles of logarithmical arithmetic have been already laid down, we ſhall here, in order to render the ſubject ſtill more plain, ſubjoin the following practical rules.

I. *Multiplication by Logarithms.*

Add together the logarithms of all the factors, and the ſum is a logarithm, the natural number correſponding to which will be the product required.

Obſerving to add, to the ſum of the affirmative indices, what is carried from the ſum of the decimal parts of the logarithms.

And that the difference betwixt the affirmative and negative indices is to be taken for the index to the logarithm of the product.

Division by Logarithms.

Ex. 1. To multiply 23·14 by 5·062.
23.14 its log. is 1·3643634
5.062 its log. is 0·7043221

Product 117.1347 - 2.0686855

Ex. 2. To mult. 2·581926 by 3·457291.
2·581926 its log. is 0·4119438
3·457291 - 0·5387359

Prod. 8.92647 - 0·9506797

Ex. 3. To mult. 3·902, and 597·16, and ·0314728 all together.
3.902 its log. is 0.5912873
597·16 - - 2·7760907
·0314728 - $\bar{2}$·4979353

Prod. 73·33533 - 1·8653133

The $\bar{2}$ cancels the 2, and the 1 to carry from the decimals is ſet down.

Ex. 4. To mult. 35·86, and 2·1046, and 0·8372, and 0·0294 all together.
3·586 its log. is 0·5546103
2·1046 - - 0·3231696
0·8372 - - $\bar{1}$·9228292
0 0294 - - $\bar{2}$·4683473

Prod. ·1857618 - $\bar{1}$·2689564

Here the 2 to carry cancels the $\bar{2}$, and there remain the $\bar{1}$, to ſet down.

II. *Diviſion by Logarithms.*

From the logarithm of the dividend ſubtract the logarithm of the diviſor, the remainder is a logarithm whoſe correſpondiug number will be the quotient required.

But firſt obſerve to change the ſign of the index of the logarithm of the diviſor, viz. from negative to affirmative, or from affirmative to negative; then take the ſum of the indices if they be of the ſame kind, or their difference when of different ſigns, with the ſign of the greater for the index of the logarithm of the quotient.

And when 1 is borrowed in the left-hand place of the decimal part of the logarithm, add it to the index of the logarithm of the diviſor when that logarithm is affirmative, but ſubtract it when negative; then let the index thus found be changed and worked with as before.

Ex. 1. To divide 24163 by 4567.
Divide 24163 its log. 4·3831509
Diviſ. 4567 - - 3·6596310

Quot. 5·290782 - 0·7235199

Ex. 2. To divide 37·149 by 523·76.
Divid. 37·149 its log. 1·5699471
Diviſ. 523·76 - - 2·7191323

Quot. ·07092752 - $\bar{2}$·8508148

Ex. 3. To divide ·06314 by ·007241.
Divid. ·06314 its log. $\bar{2}$·8003046
Diviſ. ·007241 - - $\bar{3}$·8597985

Quot. 8·719792 - 0·9405061

Here 1 carried from the decimals to the 3 makes it becomes $\bar{2}$, which taken from the other $\bar{2}$, leaves 0 remaining.

Rule of Three by Logarithms.

Ex. 4. To divide ·7438 by 12·9476.
Divid. ·7438 its log. 1·8714562
Diviſ. 12·9476 - 1·1121893

Quot. ·05744694 - $\bar{2}$·7592669

Here the 1 taken from the $\bar{1}$ makes it become $\bar{2}$ to ſet down.

III. *The Rule of Three, or Proportion.*

Add the logarithms of the 2nd and 3d terms together, and from their ſum ſubtract the logarithm of the 1ſt by the foregoing rules; the remainder will be the logarithm of the 4th term required.

Or in any compound proportion whatever, add together the logarithms of all the terms that are to be multiplied, and from that ſum take the ſum of the others; the remainder will be the logarithm of the term ſought.

But inſtead of ſubtracting any logarithm, we may add its complement, and the reſult will be the ſame. By the complement is meant the logarithm of the reciprocal of the given number or the remainder by taking the given logarithm from 0, or from 10, changing the radix from 0 to 10; the eaſieſt method of doing which, is to begin at the left hand, and ſubtract each figure from 9, except the laſt ſignificant figure on the right hand, which muſt be ſubtracted from 10. But when the index is negative, add it to 9, and ſubtract the reſt as before. And for every complement that is added, ſubtract 10 from the laſt ſum of the indices.

Ex. 1. To find a 4th proportional to 72·34, and 2·519, and 357·4862.
As 72·34 - comp. log. 8·1406215
To 2.519 - - 0·4012282
So 357·4862 - - 2 5532592

To 12·44827 - - 1·0951089

Ex. 2. To find a 3d proportional to 12·796 and 3·24718.
As 12·796 - comp. log. 8·8929258
To 3·24718 - - 0·5115064
So 3·24718 - - 0·5115064

To ·8240216 - - $\bar{1}$ 9159386

Ex. 3. To find a number in proportion to ·379145 as ·85132 is to ·0649.
As ·0649 - comp. log. 11·1877553
To ·85132 - - $\bar{1}$·9300928
So ·379145 - - $\bar{1}$·5788054

To 4·973401 - - 0·6966535

Ex. 4. If the intereſt of 100l. for a year or 365 days be 4·5l. what will be the intereſt of 279·25l. for 274 days?

$$\text{As}\begin{cases}100\\365\end{cases}\text{comp. log.}\begin{cases}8{\cdot}0000000\\7{\cdot}4377071\end{cases}$$
$$\text{To}\begin{cases}279{\cdot}25 \quad - \quad - \quad 2{\cdot}4459932\\274 \quad - \quad - \quad 2{\cdot}4377506\end{cases}$$
So 4·5 - - - 0·6532125

To 9·433296 - - 0·9746634

IV.

Involution by Logarithms.

IV. *Involution, or raiſing of Powers.*

Multiply the Logarithm of the number given by the propoſed index of the power, and the product will be the logarithm of the power ſought.

Note. In multiplying a logarithm with a negative index by any affirmative number, the product will be negative.—But what is to be carried from the decimal part of the logarithm will be affirmative.—Therefore the difference will be the index of the product; and is to be accounted of the ſame kind with the greater.

Ex. 1. To find the 2d power of 2·5791.

Root 2·5791 its log. - 0.4114682
index - - 2
Power 6·651756 - - 0·8229364

Ex. 2. To find the cube of 3·07146.

Root 3·07146 its log. - 0·4873449
indcx - - - 3
Power 28·97575 - - 1·4620347

Ex. 3. To find the 4th power of ·09163.

Root ·09163 its log. - $\bar{2}$.9620377
index - - - 4
Power ·0000704938 - $\bar{5}$·8481508

Here 4 times the negative index being $\bar{8}$, and 3 to carry, the difference $\bar{5}$ is the index of the product.

Ex. 4. To find the 365th power of 1·0045.

Root 1·0045 its log. - 0·0019499
index - - 365
97495
116994
58497
Power 5·148888 - - 0.7117135

V. *Evolution, or Extraction of Roots.*

Divide the logarithm of the power or given number by its index, and the quotient will be the logarithm of the root required.

Note. When the index of the logarithm is negative, and the diviſor is not exactly contained in it without a remainder, increaſe it by ſuch a number as will make it exactly diviſible; and carry the units borrowed, as ſo many tens, to the left-hand place of the decimal part of the logarithm; then divide the reſults by the index of the root.

Evolution by Logarithms.

Ex. 1. To find the ſquare root of 365.
Power 365 - - 2)2·5622929
Root 19·10498 - - 1.2811465

Ex. 2. To find the cube root of 12345.
Power 12345 - - 3)4·0914911
Root 23·11162 - - 1·3638304

Ex. 3. To find the 10th root of 2.
Power 2 - - - 10)0·3010300
Root 1·071773 - - 0.0301030

Ex. 4. To find the 365th root of 1·045.
Power 1·045 - - 365)0·0191163
Root 1.000121 - - 0·0000524

Ex. 5. To find the ſquare root of ·093.
Power ·093 - - 2)$\bar{2}$·9684829
Root ·304959 - - 1·4842415

Here the diviſor 2 is contained exactly once in $\bar{2}$ the negative index; therefore the index of the quotient is $\bar{1}$.

Ex. 6. To find the cube root of ·00048.
Power - - - 3)$\bar{4}$·6812412
Root ·07829735 - - $\bar{2}$·8937471

Here the diviſor 3 not being exactly contained in $\bar{4}$, augment it by 2, to make it become $\bar{6}$, in which the diviſor is contained juſt $\bar{2}$ times; and the 2 borrowed being carried to the other figures 6, &c. makes 2·6812412, which divided by 3 gives .8937471.

In trigonometry, the uſe of logarithmical ſines, tangents, &c. are uſed as well as the common arithmetical logarithms; and by uſing them according to the rules above laid down, the operations are ſhortened to a degree altogether incredible to perſons unacquainted with this invention. With equal facility are the problems in aſtronomy and navigation ſolved by their means, as well as thoſe of the higher geometry, fluxions, and in ſhort every thing which requires deep and laborious calculation. For the particular application of them to the different ſciences, ſee the articles NAVIGATION, TRIGONOMETRY, &c.

A Table of Logarithms from 1 to 10,000.

N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.	N°	Logar.
1	0.000000	12	1.079181	23	1.361728	34	1.531479	45	1.653212	56	1.748188	67	1.826075	78	1.892095	89	1.949390
2	0.301030	13	1.113943	24	1.380211	35	1.544068	46	1.662758	57	1.755875	68	1.832508	79	1.897627	90	1.954242
3	0.477121	14	1.146128	25	1.397940	36	1.556302	47	1.672098	58	1.763428	69	1.838849	80	1.903090	91	4.959041
4	0.602060	15	1.176091	26	1.414973	37	1.568202	48	1.681241	59	1.770852	70	1.845098	81	1.908485	92	1.963788
5	0.698970	16	1.204120	27	1.431364	38	1.579784	49	1.690196	60	1.778151	71	1.851258	82	1.913814	93	1.968483
6	0.778151	17	1.230449	23	1.447158	39	1.591065	50	1.698970	61	1.785330	72	1.857332	83	1.919078	94	1.973128
7	0.845098	18	1.255272	29	1.462398	40	1.602060	51	1.707570	62	1.792392	73	1.863323	84	1.924279	95	1.977724
8	0.903090	19	1.278754	30	1.477121	41	1.612784	52	1.716003	63	1.799340	74	1.869232	85	1.929419	96	1.982271
9	0.954242	20	1.301030	31	1.491362	42	1.623249	53	1.724276	64	1.806180	75	1.875061	86	1.934498	97	1.986772
10	1.000000	21	1.322219	32	1.505150	43	1.633468	54	1.732394	65	1.812913	76	1.880814	87	1.939519	98	1.991226
11	1.041393	22	1.342423	33	1.518514	44	1.643453	55	1.740363	66	1.819544	77	1.886491	88	1.944483	99	1.995635

N°	0	1	2	3	4	5	6	7	8	9	Diff.
100	2.000000	2.000434	2.000868	2.001301	2.001734	2.002166	2.002598	2.003029	2.003460	2.003891	432
101	2.004321	2.004751	2.005180	2.005609	2.006038	2.006466	2.006894	2.007321	2.007748	2.008174	428
102	2.008600	2.009026	2.009451	2.009876	2.010300	2.010724	2.011147	2.011570	2.011993	2.012415	424
103	2.012837	2.013259	2.013680	2.014100	2.014520	2.014940	2.015360	2.015779	2.016197	2.016615	419
104	2.017033	2.017451	2.017868	2.018284	2.018700	2.019116	2.019532	2.019947	2.020361	2.020775	416
105	2.021189	2.021603	2.022016	2.022438	2.022841	2.023252	2.023664	2.024075	2.024486	2.024896	412
106	2.025306	2.025715	2.026124	2.026533	2.026942	2.027350	2.027757	2.028164	2.028571	2.028978	408
107	2.029384	2.029789	2.030195	2.030600	2.031004	2.031408	2.031812	2.032216	2.032619	2.033021	404
108	2.033424	2.033826	2.034227	2.034628	2.035029	2.035430	2.035830	2.036229	2.036629	2.037028	400
109	2.037426	2.037825	2.038223	2.038620	2.039017	2.039414	2.039811	2.040207	2.040602	2.040998	396
110	2.041393	2 041787	2.042182	2.042575	2.042969	2.043362	2.043755	2.044148	3.044540	2.044931	393
111	2.045323	2.045714	2.046105	2.046495	2.046885	2.047275	2.047664	2.048053	2.048442	2.048830	389
112	2.049218	2.049606	2.049993	2.050380	2.050766	2.051152	2.051538	2.051924	2.052309	2.052694	386
113	2.053078	2.053463	2.053846	2.054230	2.054613	2.054996	2.055378	2.055760	2.056142	2.056524	382
114	2.056905	2.057286	2.057666	2.058046	2.058426	2.058805	2.059185	2.059563	2.059942	2.060320	379
115	2.060698	2.061075	2.061452	2.061829	2.062206	2.062582	2.062958	2.063333	2.063709	2.064083	376
116	2.064458	2.064832	2.065206	2.065580	2.065953	2.066326	2.066698	2.067071	2.067443	2.067814	372
117	2.068186	2.068557	2.068928	2.069298	2.069668	2.070038	2.070407	2.070766	2.071145	2.071514	369
118	2.071882	2.072250	2.072617	2.072985	2.073352	2.073718	2.074085	2.074451	2.074816	2.075182	366
119	2.075547	2.075912	2.076276	2.076640	2.077004	2.077368	2.077731	2.078094	2.078457	2.078819	363
120	2.079181	2.079543	2.079904	2.080266	2.080626	2.080987	2.081347	2.081707	2.082067	2.082426	360
121	2.082785	2.083144	2.083503	2.083861	2.084219	2.084576	2.084934	2.085291	2.085647	2.086001	357
122	2.086360	2.086716	2.087071	2.087426	2.087781	2.088136	2.088490	2.088845	2.089198	2.089552	355
123	2.089905	2.090258	2.090611	2.090963	2.091315	2.091667	2.092018	2.092370	2.092721	2.093071	351
124	2.093422	2.093772	2.094122	2.094471	2.094820	2.095169	2.095518	2.095866	2.096215	2.096562	349
125	2.096910	2.097257	2.097604	2.097951	2.098297	2.098644	2.098990	2.099335	2.099681	2.100026	346
126	2.100371	2.100715	2.101059	2.101403	2.101747	2.102090	2.102434	2.102777	2.103119	2.103462	343
127	2.103804	2.104145	2.104487	2.104828	2.105169	2.105510	2.105851	2.106191	2.106531	2.106870	340
128	2.107210	2.107549	2.107888	2.108227	2.108565	2.108903	2.109241	2.109578	2.109916	2.110253	338
129	2.110590	2.110926	2.111262	2.111598	2.111934	2.112270	2.112605	2.112940	2.113275	2.113609	335
130	2.113943	2.114277	2.114611	2.114944	2.115278	2.115610	2.115943	2.116276	2.116608	2.116940	333
131	2.117271	2.117603	2.117934	2.118265	2.118595	2.118926	2.119256	2.119586	2.119915	2.120245	330
132	2.120574	2.120903	2.121231	2.121560	2.121888	2.122216	2.122543	2.122871	2.123198	2.123525	328
133	2.123852	2.124178	2.124504	2.124830	2.125156	2.125481	2.125806	2.126131	2.126456	2.126781	325
134	2.127105	2.127429	2.127752	2.128076	2.128399	2.128722	2.129045	2.129368	2.129690	2.130012	323
135	2.130334	2.130655	2.130977	2.131298	2.131619	2.131939	2.132260	2.132580	2.132900	2.133219	321
136	2.133539	2.133858	2.134177	2.134496	2.134814	2.135133	2.135451	2.135768	2.136086	2.136403	318
137	2.136721	2.137037	2.137354	2.137670	2.137987	2.138303	2.138618	2.138934	2.139249	2.139564	315
138	2.139879	2.140194	2.140508	2.140822	2.141136	2.141450	2.141763	2.142076	2.142389	2.142702	314
139	2.143015	2.143327	2.143639	2.143951	2.144263	2.144574	2.144885	2.145196	2.145507	2.145818	311

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140	2.146128	2.146438	2.146748	2.147058	2.147367	2.147676	2.147985	2.148294	2.148603	2.148911	309
141	2.149219	2.149527	2.149835	2.150142	2.150449	2.150756	2.151063	2.151370	2.151676	2.151982	307
142	2.152288	5.152594	2.152900	2.153205	2.153510	2.153815	2.154119	2.154424	2.154728	2.155032	305
143	2.155336	2.155640	2.155943	2.156246	2.156549	2.156852	2.157154	2.157457	2.157759	2.158061	303
144	2.158362	2.158664	2.158965	2.159266	2.159567	2.159868	2.160168	2.160468	2.160769	2.161068	301
145	2.161368	2.161667	2.161967	2.162266	2.162564	2.162863	2.163161	2.163459	2.163757	2.164055	299
146	2.164353	2.164650	2.164947	2.165244	2.165541	2.165838	2.166134	2.166430	2.166726	2.167022	297
147	2.167317	2.167613	2.167908	2.168203	2·168497	2.168792	2.169086	2.169380	2.169674	2.169968	295
148	2.170262	2.170555	2.170848	2.171141	2,171434	2.171726	2.172019	2.172311	2.172603	2.172895	293
149	2.173186	2.173478	2.173769	2.174060	2.174351	2.174641	2.174932	2.175222	2.175512	2.175802	291
150	2.176091	2.176381	2.176670	2.176959	2.177248	2.177536	2.177825	2.178113	2.178401	2.178689	289
151	2.178977	2.179264	2.179552	2.179839	2.180126	2.180413	2.180699	2.180986	2.181272	2.181558	287
152	2.181844	2.182129	2.182415	2.182700	2.182985	2.183270	2.183554	2.183839	2.184123	2.184407	285
153	2.184691	2.184975	2.185259	2.185542	2.185826	2.186108	2.186391	2.186674	2.186956	2.187239	283
154	2.187521	2.187803	2.188084	2.188366	2.188647	2.188928	2.189209	2.189490	2.189771	2.190051	281
155	2.190332	2.190612	2.190892	2.191171	2.191451	2.191730	2.192010	2.192289	2.192567	2.192846	279
156	2.193125	2.193403	2.193681	2.193959	2.194237	2.194514	2.194792	2.195069	2.195346	2.195623	278
157	2.195900	2-196176	2.196452	2.196729	2.197005	2.197280	2.197556	2.197832	2.1981 7	2.198382	276
158	2.198657	2.198932	2.199206	2.199481	2.199755	2.200029	2.200303	2.200577	2.20085	2.201124	274
159	2.201397	2.201670	2.201943	2.202216	2.202488	2.202761	2.203033	2.203305	2.203577	2.203848	272
160	2.204120	2.204391	2.204662	2.204933	2.205204	2.205475	2.205745	2.206016	2.206286	2.206556	271
161	2.206826	2.207095	2.207365	2.207634	2.207903	2.208172	2.208441	2.208710	2.208978	2.209247	269
162	2.209515	2.209783	2.210051	2.210318	2.210586	2.210853	2.211120	2.211388	2.211654	2.211921	267
163	2.212188	2.212454	2.212720	2.212986	2.213252	2.213518	2.213783	2.214049	2.214314	2.214579	266
164	2.214844	2.215109	2.215373	2.215638	2.215902	2.216166	2.216430	2.216694	2.216957	2.217221	264
165	2.217484	2.217747	2.218010	2.218273	2.218535	2.218798	2.219060	2.219322	2.219584	2.219846	262
166	2.220108	2.220370	2.220631	2.220892	2.221153	2.221414	2.231675	2.221936	2.222196	2.222456	261
167	2.222716	2.222976	2.223236	2.223496	2.223755	2.224015	2.224274	2.224533	2.224792	2.225051	259
168	2.225309	2.225568	2.225826	2.226084	2.226342	2.226600	2.226858	2.227115	2.227372	2.227630	258
169	2.227887	2.228143	2.228400	2.228657	2.228913	2.229170	2.229426	2.229682	2.229938	2.230193	256
170	2.230449	2.230704	2.230960	2.231215	2.231470	2.231724	2.231979	2.232233	2.232488	2.232742	254
171	2.232996	2.233250	2.233504	2.233757	2.234011	2.234264	2.234517	2.234770	2.235023	2.235276	253
172	2.235528	2.235781	2.236033	2.236285	2.236537	2.236789	2.237041	2.237292	2.237544	2.237795	252
173	2.238046	2.238297	2.238548	2.238799	2.239049	2.239299	2.239549	2.239800	2.240050	2.240299	250
174	2.240549	2.240799	2.241048	2.241297	2.241546	2.241795	2.242044	2.242293	2.242541	2.242790	249
175	2.243038	2.243286	2.243534	2.243782	2.244030	2.244277	2.244524	2.244772	2.245010	2.245266	248
176	2.245513	2-245759	2.246006	2.246252	2.246499	2.246745	2.246991	2.247236	2.247482	2.247728	246
177	2.247973	2.248219	2.248464	2.248709	2.248954	2.249198	2.249443	2.249687	2.249932	2.250176	245
178	2.250420	2.250664	2.250908	2.251151	2.251395	2.251638	2.251881	2.252125	2.252367	2.252610	243
179	2.252853	2.253096	2.253338	2.253580	2.253822	2.254064	2.254306	2.254548	2.254790	2.255031	242
180	2.255272	2.255514	2.255755	2.255996	2.256236	2.256477	2.256718	2.256958	2.257189	2.257439	241
181	2.257679	2.257918	2.258158	2.258398	2.258637	2.258877	2.259116	2.259355	2.259594	2.259833	239
182	2.260071	2.260310	2.260548	2.260787	2.261025	2.261263	2.261501	2.261738	2.261976	2.262214	238
183	2.262451	2.262688	2.262925	2.263162	2.263399	2.263636	2.263873	2.264109	2.264345	2.264582	237
184	2.264818	2.265054	2.265290	2.265525	2.265761	2.265996	2.266232	2.266467	2.266704	2.266937	235
185	2.267172	2.267406	2.267641	2.267875	2.268110	2.268344	2.268578	2.268812	2.269046	2.269279	234
186	2.269513	2.269746	2.269980	2.270213	2.270446	2.270679	2.270912	2.271144	2.271377	2.271609	233
187	2.271842	2.272074	2.272306	2.272538	2.272770	2.273001	2.273233	2.273464	2.273696	2.273927	232
188	2.274158	2 274389	2.274620	2.274850	2.275081	2.275311	2.275542	2.275772	2.276002	2.276232	230
189	2.276462	2.276691	2.276921	2.277151	2.277380	2.277609	2.277838	2.278067	2.278296	2.278525	229
190	2.278574	2.278982	2.279210	2.279439	2.279667	2.279895	2.280123	2.280351	2.280578	2.280806	228
191	2.281033	2.281261	2.281488	2.281715	2.281942	2.282169	2.382395	2.282622	2.282849	2.283075	227
192	2.283301	2.283527	2.283753	2.283979	2.284205	2.284431	2.284656	2.284882	2.285107	2.285332	226
193	2.285557	2.285782	2.286007	2.286232	2.286456	2.286681	2.286905	2.287130	2.287354	2.287578	225
194	2.287802	2.288025	2.288249	2.288473	2.288696	2.288920	2.289143	2.289366	2.289589	2.289812	223

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195	2.290035	2.290257	2.290480	2.290702	2.290925	2.291147	2.291369	2.291591	2.291813	2.292034	222
196	2.292256	2.292478	2.292699	2.292920	2.293141	2.293362	2.293583	2.293804	2.294025	2.294246	221
197	2.294466	2.294687	2.294907	2.295127	2.295347	2.295567	2.295787	2 296007	2.296226	2.296446	220
198	2.296665	2.296884	2.297104	2.297323	2.297542	2.297760	2.297979	2.298198	2.298416	2.298635	219
199	2.298853	2.299071	2.299289	2.299507	2.299725	2.299943	2.300160	2.300378	2.300595	2.300813	218
200	2.301030	2.301247	2.301464	2.301681	2.301898	2.302114	2.302331	2.302547	2.302764	2.302980	217
201	2.303196	2.303412	2.303628	2.303844	2.304059	2.304275	2.304490	2.304706	2.304921	2.305136	216
202	2.305351	2.305566	2.305781	2.305996	2.306210	2.306425	2.306639	2.306854	2.307068	2.307282	215
203	2.307496	2.307710	2.307924	2.308137	2.308351	2.308564	2.308778	2 308991	2,309204	2.309417	213
204	2.309630	2.309843	2.310056	2.310268	2.310481	2.310693	2.310906	2.311118	2.311330	2.311542	212
205	3.311754	2-311966	2.312177	2.312389	2.312600	2.312812	2.313023	2.313324	2.313445	2.313656	211
206	2.313867	2.314078	2.314289	2.314499	2.314710	2.314920	2.315130	2.315340	2.315550	2.315760	210
207	2.315970	2.316180	2.316390	2.316599	2.316809	2.317018	2 317227	2.317436	2.317645	2.317854	209
208	2.318063	2.318272	2.318481	2.318689	2.318898	2 319106	2.319314	2.319523	2.319730	2.319938	208
209	2.320146	2.320354	2.320562	2.320769	2.320977	2.321184	2.321391	2 321598	2.321805	2.322012	207
210	2.322219	2.322426	2.322633	2.322839	2.323046	2.323252	2.323458	2.323664	2.323871	2.324077	206
211	2.324282	2.324488	2.324694	2.324899	2.325105	2.325310	2.325516	2.325721	2.325926	2.326131	205
212	2.326336	2.326541	2.326745	2.326950	2.327154	2.327359	2.327563	2.327767	2.327972	2.328176	204
213	2.328380	2.328583	2.328787	2.328991	2.329194	2.329398	2.329601	2.329804	2.330008	2.330211	203
214	2.230414	2.330617	2.330819	2.331022	2.331225	2.331427	2.331629	2.331832	2.332034	2.332236	202
215	2.332438	2.332640	2.332842	2.333044	2.333264	2.333447	2.333649	2.333850	2.334051	2.334253	202
216	2.334454	2-334655	2.334856	2.335056	2.335257	2.335458	2.335658	2.335859	2.336059	2.336259	201
217	2.336460	2.336660	2.336860	2.337060	2.337260	2.337459	2.337659	2.337858	2.338058	2 338257	200
218	2.338456	2.338656	2.338855	2.339054	2.339253	2 339451	2.339650	2.339849	2.340047	2.340246	199
219	2.340444	2.340642	2.340840	2.341039	2.341235	2.341434	2.341632	2.341830	2.342028	2.342225	198
220	2.342423	2.342620	2.342817	2.343014	2.343212	2.343409	2.343605	2.343802	2.343999	2.344196	197
221	2.344392	2.344589	2.344785	2.344981	2.345178	2.345374	2.345570	2 345766	2.345961	2.346157	196
222	2.346353	2.346540	2.346744	2.346939	2.347135	2.347330	2.347525	2.347720	2.347915	2.348110	195
223	2.348305	2.348500	2.348694	2.348889	2.349083	2.349277	2.349472	2.349660	2.349860	2.350054	194
224	2.350248	2.350442	2.350636	2.350829	2.351023	2.351216	2.351500	2.351603	2.351796	2.351989	193
225	2.352182	2.352375	2.352568	2.352761	2.352954	2.353146	2.353339	2.353532	2.353724	2.353916	193
226	2.354108	2.354301	2.354493	2.354684	2.354876	2.355068	2.355260	2.355451	2.355643	2.355834	192
227	2.356026	2.356217	2.356408	2.356599	2.356790	2.356981	2.357172	2.357363	2.357554	2.357744	191
228	2.357935	2.358125	2.358316	2.358506	2.358696	2.358886	2.359076	2.359266	2.359456	2.359646	190
229	2.359835	2.360025	2.360215	2.360404	2.360593	2.360783	2.360972	2.361161	2.361350	2.361539	189
230	2.361728	2.361917	2.362105	2.362294	2.362482	2.362671	2.362859	2.363048	2.363236	2.363424	188
231	2.363612	2.363800	2.363988	2.364176	2.364363	2.364551	2.364739	2.364926	2.365113	2.365301	188
232	2.365488	2.365675	2.365862	2.366049	2.366236	2.366423	2.366700	2.366796	2.366983	2.367169	187
233	2.367356	2.367542	2.367728	2.367915	2.368101	2.368287	2.368473	2.368659	2.368844	2.369030	186
234	2.369216	2.369401	2.369587	2.369772	2.369958	2.370143	2.370328	2.370513	2.370698	2.370883	185
235	2.371068	2.371253	2.371437	2.371622	2.371806	2.371991	2.372175	2.372360	2.372544	2.372728	184
236	2.372912	2.373096	2.373280	2.373464	2.373647	2.373831	2.374015	2.374198	2.374382	2 374565	184
237	2.374748	2.374931	2.375115	2.375298	2.375481	2.375664	2.375846	2.376029	2.376212	2 376394	183
238	2.376577	2.376759	2.376942	2.377124	2.377306	2.377488	2.377670	2.377852	2.378034	2.378216	182
239	2.378398	2.378580	2.378761	2.378943	2.379124	2.379305	2.379487	2.379668	2.379849	2.380030	181
240	2.380211	2.380392	2.380573	2.380754	2.380934	2.381115	2.381296	2 381476	2.381656	2.381837	181
241	2.382017	2.382197	2.382377	2.382557	2.382737	2.382917	2.383097	2.382277	2.383456	2.383636	180
242	2.383815	2.383992	2.384175	2.384353	2.384533	2.384712	2.384891	2.385070	2.385249	2.385427	179
243	2.385606	2.385785	2.385964	2.386142	2.386321	2.386499	2.386677	2.386855	2.387034	2.387212	178
244	2.387390	2.387568	2.387746	2.387923	2.388101	2.388279	2.388456	2.388634	2.388811	2.388989	178
245	2.389166	2.389343	2.389520	2.389697	2.389874	2.390051	2 390228	2.390405	2.390582	2.390758	277
246	2.390935	2.391112	2.391288	2.391464	2.391641	2.391817	2.391993	2.392169	2.392345	2.392521	176
247	2.392697	2.392873	2.393048	2.393224	2.393400	2.393575	2.393751	2.393926	2.394101	2.394276	176
248	2.394452	2.394627	2.394802	2.394977	2.395152	2.395326	2.395501	2.395676	2.395850	2.396025	175
249	2.396199	2.396374	2.396548	2.396722	2.396869	2.397070	2.397244	2.397418	2.397592	2.397766	174

N°	0	1	2	3	4	5	6	7	8	9	Diff.
250	2.397940	2.398114	2.398287	2.398461	2.398634	2.398808	2.398981	2.399154	2.399327	2.399501	173
251	2.399674	2.399847	2.400020	2.400192	2.400365	2.400538	2.400711	2.400883	2.401056	2.401228	173
252	2.401400	2.401573	2.401745	2.401917	2.402089	2.402261	2.402433	2.402605	2.402777	2.402949	172
253	2.403120	2.403292	2.403464	2.403635	2.403807	2.403978	2.404149	2.404320	2.404492	2.404663	171
254	2.404834	2.405005	2.405175	2.405346	2.405517	2.405688	2.405858	2.406029	2.406199	2.406370	171
255	2.406540	2.400710	2.406881	2.407051	2.407221	2.407391	2.407561	2.407731	2.407900	2.408070	170
256	2.408240	2.408409	2.408579	2.408749	2.408918	2.409087	2.409257	2.409426	2.409595	2.409764	169
257	2.409933	2.410102	2.410271	2.410440	2.410608	2.410777	2.410946	2.411114	2.411283	2.411451	169
258	2.411620	2.411788	2.411956	2.412124	2.412292	2.412460	2.412628	2.412796	2.412964	2.413132	168
259	2.413300	2.413467	2.413635	2.413802	2.413970	2.414137	2.414305	2.414472	2.414639	2.414806	167
260	2.414973	2.415140	2.415307	2.415474	2.415641	2.415808	2.415974	2.416141	2.416308	2.416474	167
261	2.416640	2.416807	2.416973	2.417139	2.417306	2.417472	2.417638	2.417804	2.417970	2.418135	166
262	2.418301	2.418467	2.418633	2.418798	2.418964	2.419129	2.419295	2.419460	2.419625	2.419791	165
263	2.419956	2.420121	2.420286	2.420451	2.420616	2.420781	2.420945	2.421110	2.421275	2.421439	165
264	2.421604	2.421768	2.421933	2.422097	2.422261	2.422426	2.422590	2.422750	2.422918	2.423082	164
265	2.423246	2.423410	2.423573	2.423737	2.423901	2.424064	2.424228	2.424391	2.424555	2.424718	164
266	2.424882	2.425045	2.425208	2.425371	2.425534	2.425697	2.425860	2.426023	2.426186	2.426349	163
267	2.426511	2.426674	2.426836	2.426999	2.427161	2.427324	2.427486	2.427648	2.427811	2.427973	162
268	2.428135	2.428297	2.428459	2.428621	2.428782	2.428844	2.429106	2.429268	2.429429	2.429591	162
269	2.429752	2.429914	2.430075	2.430236	2.430398	2.430559	2.430720	2.430881	2.431042	2.431203	161
270	2.431364	2.431525	2.431685	2.431846	2.432007	2.432167	2.432328	2.432488	2.432649	2.432809	160
271	2.432969	2.433129	2.433290	2.433450	2.433610	2.433770	2.433930	2.434090	2.434249	2.434409	160
272	2.434569	2.434728	2.434888	2.435048	2.435207	2.435366	2.435526	2.435685	2.435844	2.436003	159
273	2.436163	2.436322	2.436481	2.436640	2.436798	2.436957	2.437116	2.437275	2.437433	2.437592	159
274	2.437751	2.437909	2.438067	2.428226	2.438384	2.438542	2.438705	2.438859	2.439010	2.439175	158
275	2.439333	2.439491	2.439648	2.439806	2.439964	2.440122	2.440279	2.440439	2.440594	2.440752	158
276	2.440909	2.441066	2.441224	2.441381	2.441538	2.441695	2.441852	2.442009	2.442166	2.442323	157
277	2.442480	2.442636	2.442793	2.442950	2.443106	2.443263	2.443419	2.443576	2.443732	2.443888	157
278	2.444045	2.444201	2.444357	2.444513	2.444669	2.444825	2.444891	2.445137	2.445293	2.445448	156
279	2.445604	2.445760	2.445915	2.446071	2.446226	2.446382	2.446537	2.446692	2.446848	2.447003	155
280	2.447158	2.447313	2.447468	2.447623	2.447778	2.447933	2.448088	2.448242	2.448397	2.448552	155
281	2.448706	2.448861	2.449015	2.449170	2.449324	2.449478	2.449633	2.449787	2.449941	2.450095	154
282	2.450259	2.450403	2.450557	2.450711	2.450865	2.451018	2.451172	2.451326	2.451479	2.451633	154
283	2.451786	2.451940	2.452093	2.452247	2.452400	2.452553	2.452706	2.452859	2.453012	2.453165	153
284	2.453318	2.453471	2.453624	2.453777	2.453930	2.454086	2.454235	2.454387	2.454540	2.454692	153
285	2.454845	2.454997	2.455149	2.455302	2.455454	2.455606	2.455758	2.455910	2.456062	2.456214	152
286	2.456366	2.456518	2.456670	2.456821	2.456973	2.457125	2.457276	2.457428	2.457579	2.457730	152
287	2.457882	2.458033	2.458184	2.458336	2.458487	2.458638	2.458789	2.458940	2.459091	2.459242	151
288	2.459392	2.459643	2.459694	2.459845	2.459995	2.460146	2.460296	2.460447	2.460597	2.460747	151
289	2.460898	2.461048	2.461198	2.461348	2.461498	2.461649	2.461799	2.461948	2.462098	2.462248	150
290	2.462398	2.462548	2.462697	2.462847	2.462997	2.463146	2.463295	2.463445	2.463594	2.463744	150
291	2.463893	2.464042	2.464191	2.464340	2.464489	2.464638	2.464787	2.464936	2.465085	2.465234	149
292	2.465383	2.465532	2.465680	2.465829	2.465977	2.466125	2.466274	2.466423	2.466571	2.466719	148
293	2.466868	2.467010	2.467164	2.467312	2.467460	2.467608	2.467756	2.467904	2.468052	2.468199	148
294	2.468347	2.468495	2.468643	2.468790	2.468938	2.469085	2.469233	2.469380	2.469527	2.469675	147
295	2.469822	2.469969	2.470116	2.470263	2.470410	2.470557	2.470704	2.470851	2.470998	2.471145	147
296	2.471292	2.471438	2.471585	2.471732	2.471878	2.472024	2.472171	2.472317	2.472464	2.472610	146
297	2.472756	2.472903	2.473049	2.473195	2.473341	2.473487	2.473633	2.473779	2.473925	2.474070	146
298	2.474216	2.474362	2.474508	2.474653	2.474799	2.474944	2.475090	2.475235	2.475381	2.475526	146
299	2.475671	2.475816	2.475962	2.476107	2.476252	2.476396	2.476542	2.476687	2.476832	2.476976	145
300	2.477121	2.477266	2.477411	2.477555	2.477700	2.477844	2.477089	2.478133	2.478278	2.478422	145
301	2.478566	2.478711	2.478855	2.478999	2.479143	2.479287	2.479431	2.479575	2.479719	2.479863	144
302	2.480007	2.480151	2.480294	2.480438	2.480582	2.480725	2.480869	2.481012	2.481156	2.481299	144
303	2.481443	2.481586	2.481729	2.481872	2.482016	2.482159	2.482302	2.482445	2.482588	2.482731	143
304	2.482874	2.483016	2.483159	2.483302	2.483445	2.483587	2.482720	2.483872	2.484015	2.484157	143

N°	0	1	2	3	4	5	6	7	8	9	Diff.
305	2.484300	2.484442	2.484584	2.484727	2.484869	2.485011	2.485153	2.485295	2.485437	2.485579	142
306	2.485721	2 485863	2.486005	2.486147	2.486289	2.486430	2.486572	2.486714	2.486855	2.486997	142
307	2.487138	2.487290	2.487421	2.487563	2.487704	2.487845	2.487986	2.488127	2.488269	2.488409	141
308	2.488551	2.488692	2.488833	2.488973	2.489114	2.489255	2.489396	2.489537	2.489677	2.489818	141
309	2.489958	2.490099	2.490239	2.490280	2.490520	2.490661	2.490801	2.490941	2.491081	2.491222	140
310	2.491362	2.491502	2.491642	2.491782	2.491922	2.492062	2.492201	2.492341	2.492481	2.492621	140
311	2.492760	2.492900	2.493040	2.493179	2.493319	2.493458	2.493597	2.493737	2.493876	2.494015	139
312	2.494155	2.494294	2.494433	2.494572	2.494711	2.494850	2.494989	2.495128	2.495267	2.495406	139
313	2.495544	2.495683	2.495822	2.495960	2.496099	2.496237	2.496376	2.496514	2.496653	2.496791	139
314	2.496930	2.497068	2.497206	2.497344	2.497482	2.497621	2.497759	2.497897	2.498035	2.498173	138
315	2.498311	2.498448	2.498586	2.498724	2.498862	2.498999	2.499137	2.499275	2.499412	2.499549	138
316	2.499687	2 499824	2.499962	2.500099	2.500236	2.500374	2.500511	2.500684	2.500785	2.500922	137
317	2.501059	2.501196	2.501333	2.501470	2.501607	2.501744	2.501880	2.502017	2.502154	2.502290	137
318	2.502427	2.502564	2.502700	2.502837	2.502973	2.503109	2.503246	2.503382	2.503518	2.503654	136
319	2.503791	2.503927	2.504063	2.504199	2.504335	2.504471	2.504607	2.504743	2.504878	2.505014	136
320	2.505150	2.505286	2.505421	2.505557	2.505692	2.508528	2.505963	2.506099	2.506234	2.506369	136
321	2.506505	2.506640	2.506775	2.506911	2.507046	2.507181	2.507316	2.507451	2.507586	2.507721	135
322	2.507856	2.507991	2.508125	2.508260	2.508395	2.508510	2.508664	2.508799	2.508933	2.509068	135
323	2.509202	2.509337	2.509471	2.509606	2.509740	2.509874	2.510008	2.510143	2.510277	2.510411	134
324	2.510545	2.510679	2.510813	2.510947	2.511081	2.511215	2.511348	2.511482	2.511616	2.511749	134
325	2.511883	2.512017	2.512150	2.512284	2.512417	2.512551	2.512684	2.512818	2.512951	2.513084	133
326	2.513218	2.513351	2.513484	2.513617	2.513750	2.513883	2.514016	2.514149	2.514282	2.514415	133
327	2.514548	2.514680	2.514813	2.514946	2.515079	2.515211	2.515344	2.515476	2.515609	2.515741	133
328	2.515874	2.516006	2.516139	2.519271	2.516403	2.516535	2.516668	2.516799	2.516932	2.517064	132
329	2.517196	2.517328	2.517460	2.517592	2.517724	2.517855	2.517987	2.518119	2.518251	2.518382	132
330	2.518514	2.518645	2.518777	2.518909	2 519040	2.519171	2.519303	2.519434	2.519565	2.519697	131
331	2.519828	2.519959	2.520090	2.520221	2.520352	2.520483	2.520614	2.520745	2.520876	2.521007	131
332	2.521138	2.521269	2.521400	2.521530	2.521661	2.521792	2.521922	2.522053	2.522183	2.522314	131
333	2.522444	2.522575	2.522705	2.522835	2.522966	2.523096	2.523226	2.523356	2.523486	2.523616	130
334	2.523746	2.523876	2.524006	2.524136	2.524266	2.524396	2.524526	2.524656	2.524785	2.524915	130
335	2.525045	2.525174	2.525304	2.525433	2.525563	2.525692	2.525822	2.525951	2.526081	2.526210	129
336	2.526339	2.526468	2.526598	2.526727	2.526856	2.526985	2.527114	2.527243	2.527372	2.527501	129
337	2.527630	2.527759	2.527888	2.528016	2.528145	2.528274	2.528402	2.528531	2.528660	2.528788	129
338	2.528917	2.529045	2.529174	2.529302	2.529430	2.529559	2.529687	2.529815	2.529943	2.530072	128
339	2.530200	2.530328	2.530416	2.530584	2.530712	2.530839	2 530968	2.531095	2.531223	2.531351	128
340	2.531479	2.531607	2.531734	2.531862	2.531989	2.532117	2.532245	2.532372	2.532499	2.532627	128
341	2.532754	2.532882	2.533009	2.533136	2.533263	2.533391	2.533518	2.533645	2.533772	2.533899	127
342	2.534026	2.534153	2.534280	2.534407	2.534534	2.534661	2.534787	2.534914	2.535041	2.535167	127
343	2.535294	2.535421	2.535547	2.535674	2.535800	2.535927	2.536053	2.536179	2.536306	2.536432	126
344	2.536558	2.536685	2.536811	2.536937	2.537063	2.537189	2.537315	2.537441	2.537567	2.537693	126
345	2.537819	2.537945	2.538071	2.538197	2.538322	2.538448	2.538574	2.538699	2.538825	2.538951	126
346	2.539076	2.539202	2.539327	2.539452	2.539578	2.539704	2.539828	2.539954	2.540079	2.542024	125
347	2.540329	2.540455	2.540580	2.540705	2.540830	2.540955	2.541080	2.541205	2.541330	2.541454	125
348	2.541579	2.541704	2.541829	2.541953	2.542078	2.542203	2.542327	2.542452	2.542576	2.542701	125
349	2.542825	2.542950	2.543074	2.543199	2.543323	2.543447	2 543571	2.543696	2.543820	2.543044	124
350	2.544068	2.544192	2.544316	2.544440	2.544564	2.544688	2.544812	2.544936	2.545060	2.545183	124
351	2.545307	2.545431	2.545554	2.545678	2.545802	2.545925	2.546049	2.546172	2.546296	2.546419	124
352	2.546543	2.546666	2.546789	2.546913	2.547036	2.547159	2.547282	2.547405	2.547529	2.547652	123
353	2.547775	2.547898	2.548021	2.548144	2.548266	2.548389	2.548512	2.548635	2.548758	2.548881	123
354	2.549003	2.549126	2.549249	2.549371	2.549494	2.549616	2.549739	2.549861	2.549984	2.550106	123
355	2.550228	2.550351	2.550473	2.550595	2.550717	2.550840	2.550962	2.551084	2.551206	2.551328	122
356	2.551450	2.551572	2.551694	2.551816	2.551938	2.552059	2.552181	2.552303	2.552425	2.552546	122
357	2.552668	2.552790	2.552911	2.553033	2.553154	2.553276	2.553397	2.553519	2.553640	2.553762	121
358	2.553883	2.554004	2.554126	2.554247	2.554368	2.554489	2.554610	2.554731	2.554852	2.554973	121
359	2.555094	2.555215	2.555336	2.555457	2.545578	2.555699	2.555820	2.555940	2.556061	2.556182	121

N°	0	1	2	3	4	5	6	7	8	9	Diff.
360	2.556032	2.556423	2.556544	2.556664	2.556785	2.556905	2.557026	2.557146	2.557266	2.557387	120
361	2.557507	2.557627	2.557748	2.557868	2.557988	2.558108	2.558228	2.558348	2.558469	2.558589	120
362	2.558709	2.558828	2.558948	2.559068	2.559188	2.559308	2.559428	2.559548	2.559667	2.559787	120
363	2.559907	2.560026	2.560146	2 560265	2.560385	2.560504	2.560624	2.560743	2.560863	2.560982	119
364	2.561101	2.561221	2.561340	2.561450	2.561578	2.561697	2.561847	2.561936	2.562055	2.562174	119
365	2.562293	2.562412	2.562531	2.562650	2.562768	2.562887	2.563006	2.563125	2.563237	2.563363	119
366	2.563481	2.563600	2.563718	2.563837	2.563955	2.564074	2.564192	2.564311	2.564429	2.564548	119
367	2.564666	2.564784	2.564903	2.565021	2.565139	2.565257	2.565375	2.565494	2.565612	2.565730	118
368	2.565848	2.565966	2.566084	2.566202	2.566320	2.566437	2.566555	2.566667	2.566791	2.566909	118
369	2.567026	2.567144	2.567262	2.567379	2.567497	2.567614	2.567732	2.567849	2.567967	2.568084	118
370	2.568202	2.568319	2.568436	2.568554	2.568671	2.568788	2.568905	2.569023	2.569140	2 569257	117
371	2.569374	2.569491	2.569608	2.569725	2.569842	2.569959	2.570076	2.570193	2.570309	2.570426	117
372	2.570543	2.570660	2.570776	2.570893	2.571010	2.571126	2.571243	2.571359	2.571476	2.571592	117
373	2.571709	2.571825	2.571942	2.572050	2.572174	2.572291	2.572407	2.572523	2.572639	2.572755	11'
374	2.572872	2.572988	2.573104	2.573220	2.573336	2.573452	2.573568	2.573684	2.573800	2.573915	116
375	2.574031	2.574147	2.574263	2.574379	2.574494	2.574610	2.574726	2.574841	2.574957	2.575072	116
376	2 575188	2.575303	2.575419	2.575534	2.575650	2.575765	2.575880	2.575996	2.576111	2.576226	115
377	2.576341	2.576456	2.576572	2.576687	2.576802	2.576917	2.577032	2.577147	2.577262	2.577377	115
378	2.577492	2.577607	2.577721	2.577836	2.577951	2.578066	2.578181	2.578295	2.578410	2.578525	115
379	2.578639	2.578754	2.578868	2.578983	2.579097	2.579212	2.579326	2.579441	2.579555	2.579669	114
380	2.579784	2.579898	2.580012	2.580126	2.580240	2.580355	2.580469	2.580583	2.580697	2.580811	114
381	2.580925	2.581039	2.581153	2.581267	2.581381	2.581495	2.581608	2.581722	2.581836	2.581950	114
382	2.582063	2.582177	2.582291	2.582404	2.582518	2.582631	2.582745	2.582858	2.582972	2.583085	113
383	2.583199	2.583312	2.583425	2.583539	2.583652	2.583765	2.583879	2.583992	2.584105	2.584218	113
384	2.584331	2.584444	2.584557	2.584670	2.584785	2.584896	2.585009	2.585122	2.585235	2.585348	113
385	2.585461	2.585573	2.585686	2.585799	2.585912	2.586024	2.586137	2.586250	2.586362	2.586475	113
386	2.586587	2.586700	2.586812	2.586925	2.587037	2.587149	2.587262	2.587374	2.587486	2.587599	112
387	2.587711	2.587823	2.587935	2.588047	2.588160	2.588272	2.588384	2.588496	2.588608	2.588720	112
388	2.588832	2.588944	2.589055	2.589167	2.589279	2.589391	2.589503	2.589614	2.589726	2.589838	112
389	2.589950	2.590061	2.590173	2.590284	2.59 396	2.590507	2.590619	2.590730	2.590842	2.590953	112
390	2.590953	2.591176	2.591827	2.591398	2.591510	2.591621	2.591732	2.591843	2.591955	2.592066	111
391	2.592177	2.592288	2.592399	2.592510	2.592621	2.592932	2.592 43	2.592954	2.593064	2.593175	111
392	2.593286	2.593397	2.593508	2.593618	2.593729	2.593840	2.593950	2.594061	2.594171	2.594282	111
393	2.594392	2.594503	2.594613	2.594724	2.594834	2.594945	2.595055	2.595165	2.595276	2.595386	110
394	2.595496	2.595606	2.595717	2.595827	2.595937	2.596047	2.596157	2.596267	2.596377	2.596487	110
395	2.596597	2.596707	2 596817	2.596927	2.597037	2.597146	2.597256	2.597366	2.597476	2.597585	110
396	2.597695	2.597805	2.597914	2.598024	2.598134	2.598243	2.598353	2.598462	2.598572	2.598681	110
397	2.598790	2.598900	2.599009	2.599119	2.599228	2.599337	2.599446	2.599556	2.599665	2.599774	109
398	2.599883	2.599992	2.600101	2.600210	2.600319	2.600428	2.600537	2.600646	2.600755	2.600864	109
399	2.600973	2.601082	2.601190	2.601299	2.601408	2.601517	2.601625	2.601734	2.601843	2.601951	109
400	2.602060	2.602168	2.602277	2.602386	2.602494	2.602602	2.602711	2.602819	2.602928	2.603036	108
401	2.603144	2.603253	2.603361	2.603469	2.603577	2.603685	2.603794	2.603902	2.604010	2.604118	108
402	2.604226	2.604334	2.604442	2.604550	2.604658	2.604766	2.604874	2.604982	2.605089	2.605197	108
403	2.605305	2.605413	2.605530	2.605628	2.605736	2.605843	2.605951	2.606059	2.606166	2.606274	108
404	2.606381	2.606489	2.606596	2.606704	2.606811	2.606918	2.607026	2.607133	2.607240	2.607348	107
405	2.607455	2.607562	2.607669	2.607777	2.607884	2.607991	2.608098	2.608205	2.608312	2.608419	107
406	2.608526	2-608633	2.608740	2.608847	2.608954	2.609060	2.609167	2.609274	2.609381	2.609488	107
407	2.609594	2.609701	2.609808	2.609914	2.610021	2.610128	2.610234	2.610341	2.610447	2.610554	107
408	2.910660	2.610767	2.610873	2.610979	2.611086	2.611192	2.611298	2.611405	2.611511	2.611617	106
409	2.611723	2.611829	2.611936	2.612042	2.612148	2.612254	2.612360	2.612466	2.612572	2.612678	106
410	2.612784	2.612890	2.612996	2.613102	2.613207	2.613313	2.613419	2.613525	2.613630	2.613736	106
411	2.613842	2.613947	2.614053	2.614159	2.614264	2.614370	2.614475	2.614581	2.614686	2.614792	106
412	2.614897	2.615003	2.615108	2.615213	2.615319	2.615424	2.615529	2.615634	2.615740	2.615845	105
413	2.615950	2.616055	2.616160	2.616265	2.616370	2.616475	2.616580	2.616685	2.616790	2.616895	105
414	2.617000	2.617105	2.617210	2.617315	2.617420	2.617524	2.617629	2.617734	2.617839	2.617943	105

N°	0	1	2	3	4	5	6	7	8	9	Diff.
415	2.618048	2.618153	2.618257	2.618362	2,618466	2.618571	2.618675	2.618780	2.618884	2.618989	105
416	2.619093	2.619198	2.619302	2.619406	2.619511	2.619615	2.619719	2.619823	2.619928	2.620032	104
417	2.620136	2.620240	2.620344	2.620448	2.620552	2.620656	2.620760	2.620864	2.620968	2.621072	104
418	2.621176	2.621280	2.621384	2.621488	2.621592	2.621695	2.621799	2.621903	2.622007	2.622110	104
419	2.622214	2.622318	2.622421	2.622525	2.622628	2.622732	2.622835	2.622939	2.923032	2.623146	104
420	2.623249	2.623353	2.623456	2.623559	2.623663	2.623766	2.623869	2.623972	2.624076	2.624179	104
421	2.624282	2.624385	2.624488	2.624591	2.624694	2.624798	2.624901	2.625004	2.625107	2.625209	103
422	2.625312	2.625415	2.625518	2.625621	2.625724	2.625827	2.625929	2.626032	2.626135	2.626238	103
423	2.626340	2.626443	2.626546	2.626648	2.626751	2.626853	2.626956	2.627058	2.627161	2.627263	103
424	2.627366	2.627468	2.627571	2.627673	2.627775	2.627878	2.627980	2.628082	2.628184	2.628287	102
425	2.628389	2.628491	2.628593	2.628695	2.628797	2.628901	2.629002	2.629104	2.629206	2.629308	102
426	2.629410	2.629511	2.629613	2.629715	2.629817	2.629919	2.630021	2.630123	2.630224	2.630326	102
427	2.630428	2.630529	2.630631	2.630733	2.630834	2.630936	2 631038	2.631139	2.631241	2.631342	102
428	2.631444	2.631545	2.631647	2.631748	2.631849	2 631951	2.632052	2.632153	2.632255	2.632356	101
429	2.632457	2.632558	2.632660	2.632761	2.632862	2.632963	2.633064	2.633165	2.633266	2.633367	101
430	2.633468	2.633569	2.633670	2.633771	2.633872	2.633973	2.634074	2.634175	2.634276	2.634376	100
731	2.634477	2.634578	2.634679	2.634779	2.634880	2.634981	2,635081	2.635182	2.635283	2.635383	100
432	2.635484	2.635584	2.635685	2.635785	2.635886	2.635986	2.636086	2.636189	2.636287	2.636388	100
433	2.636488	2.636588	2.636688	2.636789	2.636889	2.636989	2.637089	2.637189	2.637289	2.637390	100
434	2.637490	2.637590	2.637690	2.637790	2.637890	2.637990	2.638090	2.638190	2.638289	2.638389	99
435	2.638489	2.638589	2.638689	2.638789	2.638888	2.638988	2.639088	2.639188	2.639287	2.639387	99
436	2.639486	2-639586	2.639686	2.639785	2.639885	2.639984	2.640084	2 640183	2.640283	2.640382	99
437	2.640481	2.640581	2.640680	2.640779	2.640879	2.640978	2.641077	2.641176	2.641276	2.641375	99
438	2.641474	2.641573	2.641672	2.641771	2.641870	2 641970	2.642069	2.642168	2.642267	2.642366	99
439	2.642464	2.642563	2.642662	2.642761	2.642860	2.642959	2.643058	2.643156	2.643255	2.643354	99
440	2.643453	2.643551	2.643650	2.643749	2.643847	2.643946	2.644044	2.644143	2.644242	2.644340	98
441	2.644439	2.644537	2.644635	2.644734	2.644832	2.644931	2.645029	2.645127	2.645226	2.645324	98
442	2.645422	2.645520	2.645619	2.645717	2.645815	2.645913	2.646011	2.646109	2.646208	2.646306	98
443	2.646404	2.646502	2.646600	2.646698	2.646796	2.646894	2.646991	2.647089	2.647187	2.647285	98
444	2.647383	2.647481	2.647578	2.647676	2.647774	2.647872	2.647969	2.648067	2.648165	2.648262	98
445	2.648360	2.648458	2.648555	2.648653	2.648750	2.648848	2.648945	2.649043	2.649140	2.649237	97
446	2.649335	2.649432	2.649530	2.649627	2.649724	2.649821	2.649919	2.650016	2.650113	2.650210	97
447	2.650307	2.650405	2.650502	2.650599	2.650696	2.650793	2.650890	2.650987	2.651084	2.651181	97
448	2.651278	2.651375	2.651472	2.651569	2.651666	2.651762	2.651859	2.651956	2.652053	2.652150	97
449	2.652246	2.652343	2.652440	2.652536	2.652633	2.652730	2.652826	2.652923	2.653019	2.653116	97
450	2.653212	2.653309	2.653405	2.653502	2.653598	2.653695	2.653791	2.653888	2.653984	2.654080	96
451	2.654176	2.654273	2.654369	2.654465	2.654562	2.654658	2.654574	2.654850	2.654946	2.655042	96
452	2.655138	2.655234	2.655331	2.655427	2.655523	2.655619	2.655714	2.955810	2.655906	2.656002	96
453	2.656098	2.656194	2.656290	2.656386	2.656481	2.656577	2.656673	2.656769	2.656864	2.656960	96
454	2.657056	2.657151	2.657247	2.657343	2.657438	2.657534	2.657629	2.657725	2.657820	2.657916	96
455	2.658011	2.658107	2.658202	2.658298	2.658393	2.658488	2.658584	2.658679	2,658774	2.658870	95
456	2.658965	2.659060	2.659155	2.659250	2.659346	2.659441	2.659536	2.659631	2.659726	2.659821	95
457	2.659916	2.660011	2.660106	2.660201	2.660296	2.660391	2.660486	2.660581	2.660676	2.660771	95
458	2.660865	2.660960	2.661055	2.661150	2.661245	2.661339	2.661434	2.651529	2.661623	2 661718	95
459	2.661813	2.661907	2.662002	2.662096	2.662191	2.662285	2.662380	2.662474	2.662569	2.662663	95
460	2.662758	2.662852	2.662947	2.663041	2.663135	2.663230	2.663324	2.663418	2.663512	2.663607	94
461	2.663701	2.663795	2.663889	2.663983	2.664078	2.664172	2.664266	2.664360	2.664454	2.664548	94
462	2.664642	2.664736	2.664830	2.664924	2.665018	2.665112	2.665206	2.665299	2.665393	2.665487	94
463	2.665581	2.665675	2.665768	2.665862	2.665956	2.666050	2.666143	2.666237	2.666331	2.666424	94
464	2.666518	2.666612	2.666705	2.666799	2.666892	2.666986	2.667079	2.667173	2.667266	2.667359	94
465	2.667453	2.667546	2.667640	2.667733	2.667826	2.667920	2.668013	2.668106	2.668199	2.668293	93
466	2.668386	2.668479	2.668572	2.668665	2.668758	2.668852	2.668945	2.669038	2.669131	2.669224	93
467	2.669317	2·669410	2.669503	2.669596	2.669689	2.669782	2.669874	2.669967	2.670060	2.670153	93
468	2.670246	2.670339	2.670431	2.670524	2.670617	2.670710	2.670802	2.670895	2.670988	2.671080	93
469	2.671173	2.671265	2.671358	2.671451	2.671543	2.671636	2.671728	2.671821	2.671913	2.672005	93

N°	0	1	2	3	4	5	6	7	8	9	Diff
470	2.672098	2.672190	2.672283	2.672375	2.672467	2.672560	2.672652	2.672744	2.672836	2.672929	92
471	2.673021	2.673113	2.673205	2.673297	2.673390	2.673482	2.673574	2.673666	2.673758	2.673850	92
472	2.673942	2.674034	2.674126	2.674218	2.674315	2.674402	2.674494	2.674586	2.674677	2.674769	92
473	2.674861	2.674953	2.675045	2.675136	2.675228	2.675320	2.675412	2.675503	2.675595	2.676687	92
474	2.675778	2.675870	2.675961	2.676053	2.676145	2.676236	2.676328	2.676419	2.676511	2.676602	92
475	2.676694	2.676785	2.676876	2.676968	2.677059	2.677150	2.677242	2.677333	2.677424	2.677516	91
476	2.677607	2.677698	2.677789	2.677881	2.677972	2.678063	2.678154	2.678245	2.678336	2.678427	91
477	2.678518	2.678609	2.678700	2.678791	2.678882	2.678973	2.679064	2.679155	2.679246	2.679337	91
478	2.679428	2.679519	2.679610	2.679700	2.679791	2.679882	2.679973	2.680063	2.680154	2.680245	91
479	2.680335	2.680426	2.680517	2.680607	2.680698	2.680789	2 680879	2.680970	2.681060	2.681151	91
480	2.681241	2.681332	2.681422	2.681513	2.681603	2.681693	2.681784	2.681874	2.681964	2.682055	90
481	2.682145	2.682235	2.682326	2.682416	2.682506	2.682596	2.682686	2.682777	2.682867	2.682957	90
482	2.683047	2.683137	2.683227	2.683317	2.683407	2.683497	2.683587	2.683677	2.683767	2.683857	90
483	2.683947	2.684037	2.684127	2.684217	2.684307	2.684396	2.684486	2.684576	2.684666	2.684756	90
484	2.684845	2.684935	2.685025	2.685114	2.685204	2.685294	2.685383	2.685472	2.685563	2.685652	90
485	2.685742	2.685831	2.685921	2.686010	2.686100	2.686189	2.686279	2.686368	2.686457	2.686547	89
486	2.686636	2.686726	2.686815	2.686904	2.686994	2.687083	2.687172	2.687261	2.687351	2.687440	89
487	2.687529	2.687618	2.637707	2.687796	2.687885	2.687975	2.688064	2.688153	2.688242	2.688331	89
488	2.688420	2.688509	2.688598	2.688687	2.638776	2.688865	2.688953	2.689042	2.689131	2.689220	89
489	2.689309	2.689398	2.689486	2.689575	2.689664	2.689753	2.689841	2.689930	2.690019	2.690107	89
490	2.690196	2.690285	2.690373	2.690462	2.690550	2.690639	2.690727	2.690816	2.690905	2.690993	89
491	2.691081	2.691170	2.691258	2.691347	2.691435	2.691523	2.691612	2.691700	2.691788	2.691877	88
492	2.691965	2.692053	2.692142	2.692230	2.692318	2.692406	2.692494	2.692583	2.692671	2.692759	88
493	2.692847	2.692935	2.693023	2.693111	2.693199	2.693287	2.693375	2.693463	2.693551	2.693639	88
494	2.693727	2.693815	2.693903	2.693991	2.694078	2.694166	2.694254	2.694342	2.694430	2.694517	88
495	2.694605	2.694693	2.694781	2.694868	2.694956	2.695044	2.695131	2.695219	2.695306	2.695394	88
496	2.695482	2.695569	2.695657	2.695744	2.695832	2.695919	2.696007	2.696094	2.696182	2.696269	87
467	2.696356	2.696444	2.696531	2.696618	2.696706	2.696793	2.696880	2.696968	2.697055	2.697142	87
498	2.697229	2.697316	2.697403	2.697491	2.697578	2.697665	2.697752	2.697839	2.697926	2.698013	87
499	2.698100	2.698188	2.698275	2.698362	2.698448	2.698535	2.698622	2.698709	2.698736	2.698883	87
500	2.698970	2.699057	2.699144	2.699230	2.699317	2.699404	2.699491	2.699578	2.699664	2.699751	87
501	2.699838	2 699924	2.700011	2.700098	2.700184	2.700271	2.700357	2.700444	2.700531	2.700617	87
502	2.700704	2.700790	2.700877	2.700963	2.701050	2.701136	2.701222	2.701309	2.701395	2.701482	86
503	2.701568	2.701654	2.701741	2.701827	2.701913	2.701999	2.702086	2.702172	2.702258	2.702344	86
504	2.702430	2.702517	2.702603	2.702689	2.702775	2.702861	2.702947	2.703033	2.703119	2.703205	86
505	2 703291	2.703377	2.703463	2.703549	2.703635	2.703721	2.703807	2.703893	2.703979	2.704065	86
506	2.704150	2.704236	2.704322	2.704408	2.704494	2.704579	2.704665	2.704751	2.704837	2.704922	86
507	2.705008	2.705094	2.705179	2.705265	2.705350	2.705436	2.705522	2.705607	2.705693	2.705778	86
508	2.705864	2.705949	2.706035	2.706120	2.706205	2.706291	2.706376	2.706462	2.706547	2.706632	85
509	2.706718	2.706803	2.706888	2.706974	2.707059	2.707144	2.707229	2.707315	2.707400	2.707485	85
510	2.707570	2.707655	2.707740	2.707826	2.707911	2.707996	2.708081	2.708166	2.708251	2.708336	85
511	2.708421	2.708506	2.708591	2.708676	2.708761	2.708846	2.708931	2.709015	2.709100	2.709185	85
512	2.709270	2.709355	2.709440	2.709524	2.709609	2.709694	2.709779	2.709863	2.709948	2.710033	85
513	2.710117	2.710202	2.710287	2.710371	2.710455	2.710540	2.710625	2.710710	2.710794	2.710879	85
514	2.710963	2.711048	2.711132	2.711216	2.711301	2.711385	2.711470	2.711554	2.711638	2.711723	84
515	2.711807	2.711891	2.711976	2.712060	2.712144	2.712229	2.712313	2.712397	2.712481	2.712565	84
516	2.712650	2.712734	2.712818	2.712902	2.712986	2.713070	2.713154	2.713238	2.713322	2.713406	84
517	2.713490	2.713574	2.713658	2.713742	2.713836	2.713910	2.713994	2.714078	2.714162	2.714246	84
518	2.714330	2.714414	2.714497	2.714581	2 714665	2.714749	2.714832	2.714916	2.715000	2.715084	84
519	2.715167	2.715251	2.715335	2.715418	2.715502	2.715586	2.715669	2.715753	2.715836	2.715920	84
520	2.716003	2.716087	2.716170	2.716254	2.716337	2.716421	2.716504	2.716588	2.716671	2.716754	83
521	2.716838	2.716921	2.717004	2.717088	2.717171	2.717254	2.717338	2.717421	2.717504	2.717587	83
522	2.717670	2.717754	2.717837	2.717920	2.718003	2.718086	2.718169	2.718253	2.718336	2.718419	83
523	2.718502	2.718585	2.718668	2.718571	2.718834	2.718917	2.719000	2.719083	2.719165	2.719248	83
524	2.719331	2.719414	2.719497	2 719580	2.719662	2.719745	2.719828	2.719911	2.719904	2.720077	83

N°	0	1	2	3	4	5	6	7	8	9	Diff.
525	2.720159	2.720242	2.720325	2.720407	2.720490	2.720573	2.720655	2.720738	2.720821	2.720903	83
526	2.720986	2.721068	2.721151	2.721233	2.721316	2.721398	2.721481	2.721563	2.721646	2.721728	82
527	2.721811	2.721893	2.721975	2.722058	2.722140	2.722222	2.722305	2.722387	2.722469	2.722552	82
528	2.722634	2.722716	2.722798	2.722881	2.722963	2.723045	2.723127	2.723209	2.723291	2.723374	82
529	2.723456	2.723538	2.723620	2.723702	2.723784	2.723866	2.723948	2.724030	2.724112	2.724194	82
530	2.724276	2.724358	2.724440	2.724522	2.724603	2.724685	2.724767	2.724849	2.724931	2.725013	82
531	2.725094	2.725176	2.725258	2.725340	2.725421	2.725593	2.725585	2.725667	2.725748	2.725830	82
532	2.725912	2.725993	2.726075	2.726156	2.726238	2.726320	2.726401	2.726483	2.726564	2.726646	82
533	2.726727	2.726809	2.726890	2.726972	2.727053	2.727134	2.727216	2.727297	2.727379	2.727420	81
534	2.727541	2.727623	2.727704	2.727785	2.727866	2.727948	2.728029	2.728116	2.728191	2.728273	81
535	2.728354	2.728435	2.728516	2.728597	2.728679	2.728759	2.728841	2.728922	2.729003	2.729084	81
536	2.729165	2.729246	2.729327	2.729408	2.729489	2.729570	2.729651	2.729732	2.729813	2.729893	81
537	2.729974	2.730055	2.730136	2.730217	2.730298	2.730378	2.730459	2.730540	2.730621	2.730702	81
538	2.730782	2.730863	2.730944	2.731024	2.731105	2.731186	2.731266	2.731347	2.731428	2.731508	81
539	2.731589	2.731669	2.731750	2.731839	2.731911	2.731991	2.732072	2.732153	2.732233	2.732313	81
540	2.732394	2.732474	2.732555	2.732635	2.732715	2.732796	2.732876	2.732956	2.733037	2.733177	80
541	2.733797	2.733277	2.733358	2.733438	2.733518	2.733598	2.733679	2.733759	2.733839	2.733919	80
542	2.733999	2.734079	2.734159	2.734240	2.734320	2.734400	2.734480	2.734560	2.734640	2.734720	80
543	2.734800	2.734880	2.734960	2.735040	2.735129	2.735200	2.735279	2.735359	2.735439	2.735519	80
544	2.735599	2.735679	2.735758	2.735838	2.735918	2.735998	2.736078	2.736157	2.736237	2.736317	80
545	2.736396	2.736476	2.736556	2.736635	2.736715	2.736795	2.736874	2.736954	2.737034	2.737113	80
546	2.737193	2.737272	2.737352	2.737431	2.737511	2.737590	2.737670	2.737749	2.737829	2.737908	79
547	2.737987	2.738067	2.738146	2.738225	2.738305	2.738384	2.738463	2.738543	2.738622	2.738701	79
548	2.738781	2.738860	2.738939	2.739018	2.739096	2.739177	2.739256	2.739335	2.739414	2.739493	79
549	2.739572	2.739651	2.739730	2.739810	2.739889	2.739968	2.740047	2.740126	2.740205	2.740284	79
550	2.740363	2.740442	2.740521	2.740599	2.740678	2.740757	2.740836	2.740915	2.740994	2.741073	79
551	2.741152	2.741230	2.741309	2.741388	2.741467	2.741546	2.741634	2.741703	2.741782	2.741860	79
552	2.741939	2.742018	2.742096	2.742175	2.762254	2.742332	2.742411	2.742489	2.742568	2.742647	79
553	2.742725	2.742804	2.742882	2.742951	2.743039	2.743118	2.743196	2.743275	2.743353	2.743431	78
554	2.743510	2.743588	2.743666	2.743745	2.743823	2.743902	2.743980	2.744058	2.744136	2.744215	78
555	2.744293	2.744371	2.744449	2.744528	2.744606	2.744684	2.744762	2.744840	2.744919	2.744997	78
556	2.745075	2.745153	2.745231	2.745309	2.745387	2.745465	2.745543	2.745621	2.745699	2.745777	78
557	2.745855	2.745933	2.746011	2.746089	2.746167	2.746245	2.746323	2.746401	2.747479	2.746556	78
558	2.746634	2.746712	2.746790	2.746868	2.746945	2.747023	2.747101	2.747179	2.747256	2.747334	78
559	2.747412	2.747489	2.747567	2.747645	2.747722	2.747800	2.747878	2.747955	2.748033	2.748110	78
560	2.748188	2.748266	2.748343	2.748421	2.748498	2.748576	2.748653	2.748731	2.748808	2.748885	77
561	2.748963	2.749040	2.749118	2.749195	2.749272	2.749350	2.749427	2.749504	2.749582	2.749659	77
562	2.749736	2.749814	2.749891	2.749968	2.750045	2.750123	2.750200	2.750277	2.750354	2.750431	77
563	2.750508	2.750586	2.750663	2.750740	2.750817	2.750894	2.750971	2.751040	2.751125	2.751202	77
564	2.751279	2.751356	2.751433	2.751510	2.751587	2.751664	2.751741	2.751818	2.751895	2.751972	77
565	2.752048	2.752125	2.752202	2.752279	2.752356	2.752433	2.752509	2.752586	2.752663	2.752740	77
566	2.752816	2.752893	2.752970	2.753047	2.753123	2.753200	2.753277	2.753354	2.753430	2.753506	77
567	2.753583	2.753660	2.753735	2.753813	2.753889	2.753966	2.754042	2.754119	2.754195	2.754272	77
568	2.754348	2.754425	2.754501	2.754578	2.754654	2.754730	2.754807	2.754883	2.754960	2.755035	76
569	2.755112	2.755189	2.755265	2.755341	2.755417	2.755494	2.755570	2.755646	2.755722	2.755799	76
570	2.755875	2.755951	2.756027	2.756103	2.756180	2.756256	2.756332	2.756408	2.756484	2.756560	76
571	2.756636	2.756712	2.756788	2.756878	2.756940	2.757016	2.757092	2.757168	2.757244	2.757320	76
572	2.757396	2.757472	2.757548	2.757624	2.757700	2.757773	2.757851	2.757927	2.758003	2.758079	76
573	2.758155	2.758230	2.758306	2.758382	2.758458	2.758539	2.758609	2.758685	2.758761	2.758836	76
574	2.758912	2.758988	2.759063	2.759139	2.759214	2.759290	2.759366	2.759441	2.759517	2.759592	76
575	2.759668	2.759743	2.759819	2.759894	2.759970	2.760045	2.760121	2.760196	2.760272	2.760347	75
576	2.760422	2.760498	2.760573	2.760649	2.760724	2.760799	2.760875	2.760950	2.761025	2.761101	75
577	2.761176	2.761251	2.761326	2.761402	2.761477	2.761552	2.761727	2.761702	2.761778	2.761853	75
578	2.761928	2.762003	2.762078	2.762153	2.762228	2.762303	2.762378	2.762453	2.762529	2.762604	75
579	2.762679	2.762764	2.762820	2.762904	2.762978	2.763053	2.763128	2.763203	2.763278	2.763355	75

N°	0	1	2	3	4	5	6	7	8	9	Diff.
580	2.763428	2.763503	2.763578	2.763653	2.763727	2.763802	2.763877	2.763952	2.764027	2.764101	75
581	2.764176	2.764251	2.764326	2.764400	2.764475	2.764550	2.764624	2.764699	2.764774	2.764848	75
582	2.764923	2.764998	2.765072	2.765147	2.765221	2.765296	2.765370	2.765445	2.765520	2.765594	75
583	2.765669	2.765743	2.765818	2.765892	2.765966	2.766041	2.766115	2.766190	2.766264	2.766338	74
584	2.766413	2.766487	2.766562	2.766636	2.766710	2.766785	2.766859	2.766933	2.767007	2.767082	74
585	2.767156	2.767230	2.767304	2.767379	2.767453	2.767525	2.767601	2.767675	2.767749	2.767823	74
586	2.767878	2.767972	2.768046	2.768120	2.768194	2.768268	2.768343	2.768416	2.768490	2.768564	74
587	2.768638	2.768711	2.768786	2.768860	2.768934	2.769008	2.769082	2.769156	2.769230	2.769303	74
588	2.769377	2.769451	2.769525	2.769599	2.769673	2.769746	2.769820	2.769894	2.769968	2.770042	74
589	2.770115	2.770189	2.770263	2.770336	2.770410	2.770484	2.770557	2.770631	2.770705	2.770778	74
590	2.770852	2.770926	2.770999	2.771073	2.771146	2.771220	2.771293	2.771367	2.771440	2.771514	74
591	2.771587	2.771661	2.771734	2.771808	2.771881	2.771955	2.772028	2.772102	2.772175	2.772248	73
592	2.772322	2.772395	2.772468	2.772542	2.772615	2.772688	2.772762	2.772835	2.772908	2.772981	73
593	2.773055	2.773128	2.773201	2.773274	2.773348	2.773421	2.773494	2.773567	2.773640	2.773713	.73
594	2.773786	2.773860	2.773933	2.774006	2.774079	2.774152	2.774225	2.774298	2.774371	2.774444	73
595	2.774517	2.774590	2.774663	2.774736	2.774809	2.774882	2.774955	2.775028	2.775100	2.775173	73
596	2.775240	2.775319	2.775392	2.775465	2.775538	2.775610	2.775683	2.775756	2.775829	2.775902	73
597	2.775974	2.776047	2.776120	2.776193	2.776265	2.776338	2.776411	2.776483	2.776556	2.776629	73
598	2.776701	2.776774	2.776846	2.776919	2.776992	2.777064	2.777137	2.777209	2.777282	2.777354	73
599	2.777427	2.777499	2.777572	2.777644	2.777717	2.777789	2.777862	2.777934	2.778006	2.778079	72
600	2.778151	2.778224	2.778296	2.778368	2.778441	2.778513	2.778585	2.778658	2.778730	2.778802	72
601	2.778874	2.778947	2.779019	2.779091	2.779163	2.779236	2.779308	2.779380	2.779452	2.779524	72
602	2.779596	2.779669	2.779741	2.779813	2.779885	2.779957	2.780029	2.780101	2.780173	2.780245	72
603	2.780317	2.780389	2.780461	2.780533	2.780605	2.780677	2.780749	2.780821	2.780893	2.780965	72
604	2.781037	2.781109	2.781181	2.781253	2.781324	2.781396	2.781468	2.781540	2.781612	2.781684	72
605	2.781755	2.781827	2.781899	2.781971	2.782042	2.782114	2.782186	2.782258	2.782329	2.782401	72
606	2.782473	2.782544	2.782616	2.782688	2.782759	2.782831	2.782902	2.782974	2.783046	2.783117	71
607	2.783189	2.783260	2.783332	2.783403	2.783475	2.783546	2.783618	2.783689	2.783761	2.783832	71
608	2.783904	2.783975	2.784046	2.784118	2.784189	2.784261	2.784332	2.784403	2.784475	2.784546	71
609	2.784617	2.784689	2.784760	2.784831	2.784902	2.784974	2.785045	2.785116	2.785187	2.785259	71
610	2.785330	2.785401	2.785472	2.785543	2 785615	2.785686	2.785757	2.785828	2.785899	2.785970	71
611	2.786041	2.786112	2.786183	2.786254	2.786325	2.786396	2.786467	2.786538	2.786609	2.786680	71
612	2.786751	2.786822	2.786893	2.786964	2.787035	2.787106	2.787177	2.787248	2.787319	2.787390	71
613	2.787460	2.787531	2.787602	2.787673	2.787744	2.787815	2.787885	2.787956	2.788027	2.788098	71
614	2.788168	2.788239	2.788310	2.788381	2.788451	2.788522	2.788593	2.788663	2.788734	2.788804	71
615	2.788875	2.788946	2.789016	2.789087	2.789152	2.789228	2.789299	2.789369	2.789440	2.789510	71
616	2.789581	2.789651	2.789722	2.789792	2.789863	2.789933	2.790003	2.790074	2.790144	2.790215	70
617	2.790285	2.790356	2.790426	2.790496	2.790567	2.790637	2.790707	2.790778	2.790848	2.790918	70
618	2.790988	2.791059	2.791129	2.791199	2.791269	2.791340	2.791410	2.791480	2.791550	2.791620	70
619	2.791691	2.791761	2 791831	2.791901	2.791971	2.792041	2.792111	2.792181	2.792252	2.792322	70
620	2.792392	2.792462	2.792532	2.792602	2.792672	2.792742	2.792812	2.792882	2.792952	2.793022	70
621	2.793092	2.793162	2.793231	2.793301	2.793371	2.793441	2.793511	2.793581	2.793651	2.793721	70
622	2.793790	2.793860	2.793930	2.794000	2.794070	2.794139	2.794209	2.794279	2.794349	2.794418	70
623	2.794488	2.794558	2.794627	2.794697	2.794767	2.794836	2.794906	2.794970	2.795045	2.795115	70
624	2.795185	2.795254	2.795324	2.795393	2.795463	2.795532	2.795602	2.795671	2.795741	2.795810	70
625	2.795880	2.795949	2.796019	2.796088	2.796158	2.796227	2.796297	2.796366	2.796436	2.796505	69
626	2.796574	2.796644	2.796713	2.796782	2.796852	2.796921	2.796990	2.797060	2.797129	2.797198	69
627	2.797268	2.797337	2.797406	2.797475	2.797545	2.797614	2.797683	2.797752	2.797821	2.797890	69
628	2.797960	2.798029	2.798098	2.798167	2.798236	2.798305	2.798374	2.798443	2.798512	2.798582	69
629	2 798651	2.798720	2.798789	2.798858	2.798927	2.798996	2.799065	2.799134	2.799203	2.799272	69
630	2.799341	2.799409	2.799478	2 799547	2.799616	2.799685	2.799754	2.799823	2.799892	2.799960	69
631	2.800029	2.800098	2.800167	2.800236	2.800305	2.800373	2.800442	2.800511	2.800580	2.800648	69
632	2.800717	2.800786	2.800854	2.800923	2.800992	2.801060	2.801129	2.801198	2.801267	2.801335	69
633	2.801404	2.801472	2.801541	2.801609	2.801678	2.801747	2.801815	2.801884	2.801952	2.802021	69
634	2.802089	2.802158	2 802226	2.802295	2.802363	2.802432	2.802500	2.802568	2.802637	2.802705	68

N°	0	1	2	3	4	5	6	7	8	9	Diff.
635	2.802774	2.802842	2.802910	2.802979	2.803047	2.803116	2.803184	2.803252	2.803321	2.803389	68
636	2.803457	2.803525	2.803594	2.803662	2.803730	2.803798	2.803867	2.803935	2.804003	2.804071	68
637	2.804139	2.804208	2.804276	2.804344	2.804412	2.804480	2.804548	2.804616	2.804685	2.804753	68
638	2.804821	2.804889	2.804957	2.805025	2.805093	2.805161	2.805229	2.805297	2.805365	2.805433	68
639	2.805501	2.805569	2.805637	2.805705	2.805773	2.805840	2.805908	2.805976	2.806044	2.806112	68
640	2.806180	2.806248	2.806316	2.806384	2.806451	2.806519	2.806587	2.806655	2.806723	2.806790	68
641	2.806858	2.806926	2.806994	2.807061	2.807129	2.807197	2.807264	2.807332	2.807400	2.807467	68
642	2.807535	2.807603	2.807670	2.807738	2.807806	2.807873	2.807941	2.808008	2.808076	2.808143	68
643	2.808211	2.808279	2.808346	2.808414	2.808481	2.808548	2.808616	2.808683	2.808751	2.808818	68
644	2.808886	2.808953	2.809021	2.809088	2.809155	2.809223	2.809290	2.809358	2.809425	2.809492	67
645	2.809560	2.809627	2.809694	2.809762	2.809829	2.809896	2.809963	2.810031	2.810098	2.810165	67
646	2.810235	2.810300	2.810367	2.810434	2.810501	2.810568	2.810636	2.810703	2.810770	2.810837	67
647	2.810904	2.810971	2.811038	2.811106	2.811173	2.811240	2.811307	2.811374	2.811441	2.811508	67
648	2.811575	2.811642	2.811709	2.811776	2.811843	2.811910	2.811977	2.812044	2.812111	2.812178	67
649	2.812245	2.812312	2.812378	2.812445	2.812512	2.812579	2.812646	2.812713	2.812780	2.812846	67
650	2.812913	2.812980	2.813047	2.813114	2.813180	2.813247	2.813314	2.813381	2.813447	2.813514	67
651	2.813581	2.813648	2.813714	2.813781	2.813848	2.813914	2.813980	2.814047	2.814114	2.814181	67
652	2.814248	2.814314	2.814381	2.814447	2.814514	2.814580	2.814647	2.814714	2.814780	2.814847	67
653	2.814913	2.814980	2.815046	2.815112	2.815179	2.815246	2.815312	2.815378	2.815445	2.815511	66
654	2.815578	2.815644	2.815710	2.815777	2.815843	2.815910	2.815976	2.816042	2.816109	2.816175	66
655	2.816241	2.816308	2.816374	2.816440	2.816506	2.816573	2.816639	2.816705	2.816771	2.816838	66
656	2.816904	2.816970	2.817036	2.817102	2.817169	2.817235	2.817301	2.817367	2.817433	2.817499	66
657	2.817565	2.817631	2.817698	2.817764	2.817830	2.817896	2.817962	2.818028	2.818094	2.818100	66
658	2.818226	2.818292	2.818358	2.818424	2.818490	2.818556	2.818622	2.818668	2.818754	2.818819	66
659	2.818885	2.818951	2.819017	2.819083	2.819149	2.819215	2.819281	2.819346	2.819412	2.819478	66
660	2.819544	2.819610	2.819675	2.819741	2.819807	2.819873	2.819939	2.820004	2.820070	2.820136	66
661	2.820201	2.820267	2.820333	2.820398	2.820464	2.820530	2.820595	2.820661	2.820727	2.820792	66
662	2.820858	2.820924	2.820989	2.821055	2.821120	2.821186	2.821251	2.821317	2.821482	2.821448	66
663	2.821513	2.821579	2.821644	2.821710	2.821775	2.821841	2.821906	2.821972	2.822037	2.822103	65
664	2.822168	2.822233	2.822299	2.822364	2.822430	2.822495	2.822560	2.822626	2.822691	2.822756	65
665	2.822822	2.822887	2.822952	2.823017	2.823083	2.823148	2.823213	2.823279	2.823344	2.823409	65
666	2.823474	2.823539	2.823605	2.823670	2.823735	2.823800	2.823865	2.823930	2.823996	2.824061	65
667	2.824126	2.824191	2.824256	2.824321	2.824386	2.824451	2.824516	2.824581	2.824646	2.824711	65
668	2.824776	2.824841	2.824906	2.824971	2.825036	2.825101	2.825166	2.825231	2.825296	2.825361	65
669	2.825426	2.825401	2.825556	2.825620	2.825686	2.825751	2.825815	2.825880	2.825945	2.826010	65
670	2.826075	2.826140	2.826204	2.826269	2.826334	2.826399	2.826464	2.826528	2.826593	2.826658	65
671	2.826722	2.826787	2.826852	2.826917	2.826981	2.827046	2.827111	2.827175	2.827240	2.827305	65
672	2.827369	2.827434	2.827498	2.827563	2.827628	2.827692	2.827757	2.827821	2.827886	2.827950	65
673	2.828015	2.828080	2.828144	2.828209	2.828273	2.828338	2.820402	2.828466	2.828531	2.828595	64
674	2.828660	2.828724	2.828789	2.828853	2.828918	2.828982	2.829046	2.829111	2.829175	2.829239	64
675	2.829304	2.829368	2.829432	2.829497	2.829561	2.829625	2.829690	2.829754	2.829818	2.829882	64
676	2.829947	2.830011	2.830075	2.830139	2.830204	2.830268	2.830332	2.830396	2.830460	2.830524	64
677	2.830589	2.830653	2.830717	2.830781	2.830845	2.830909	2.830973	2.831037	2.831102	2.831166	64
678	2.831230	2.831294	2.831358	2.831422	2.831486	2.831550	2.831614	2.831678	2.831742	2.831806	64
679	2.831870	2.831934	2.831998	2.832062	2.832125	2.832189	2.832253	2.832317	2.832381	2.832445	64
680	2.832509	2.832573	2.832637	2.832700	2.832764	2.832828	2.832892	2.832956	2.833019	2.833083	64
681	2.833147	2.833211	2.833275	2.833338	2.833402	2.833466	2.833530	2.833593	2.833657	2.833721	64
682	2.833784	2.833848	2.833912	2.833975	2.834039	2.834103	2.834166	2.834230	2.834293	2.834357	64
683	2.834421	2.834484	2.834548	2.834611	2.834675	2.834738	2.834802	2.834866	2.834929	2.834993	64
684	2.835056	2.835120	2.835183	2.835246	2.835310	2.835373	2.835437	2.835500	2.835564	2.835627	63
685	2.835691	2.835754	2.835817	2.835881	2.835944	2.836007	2.836071	2.836134	2.836197	2.836261	63
686	2.836324	2.836387	2.836451	2.836514	2.836577	2.836640	2.836704	2.836767	2.836830	2.836893	63
687	2.836957	2.837070	2.837083	2.837116	2.837209	2.837273	2.837336	2.837399	2.837462	2.837525	63
688	2.837588	2.837652	2.837715	2.837778	2.837841	2.837904	2.837967	2.838030	2.838093	2.838156	63
689	2.838219	2.838282	2.838345	2.838408	2.838471	2.838534	2.838597	2.838660	2.838723	2.838786	63

N°	0	1	2	3	4	5	6	7	8	9	Diff.
690	2.838849	2.838912	2.838975	2.839038	2.839101	2.839164	2.839227	2.839289	2.839352	2.839415	63
691	2.839478	2.839541	2.839604	2.839667	2.839729	2.839792	2.839855	2.839918	2.839981	2.840043	63
692	2.840106	2.840169	2.840232	2.840294	2.840357	2.840420	2.840482	2.840545	2.840608	2.840671	63
693	2.840733	2.840796	2.840859	2.840921	2.840984	2.841046	2.841109	2.841172	2.841234	2.841297	63
694	2.841359	2.841422	2.841485	2.841547	2.841610	2.841672	2.841735	2.841797	2.841860	2.841922	63
695	2.841985	2.842047	2.842110	2.842172	2.842235	2.842297	2.842360	2.842422	2.842484	2.842543	62
696	2.842609	2.842672	2.842734	2.842796	2.842859	2.842921	2.842983	2.843046	2.843108	2.843170	62
697	2.843233	2.843295	2.843357	2.843420	2.843482	2.843544	2.843606	2.843669	2.843731	2.843793	62
698	2.843855	2.843918	2.843980	2.844042	2.844104	2.844166	2.844229	2.844291	2.844353	2.844415	62
699	2.844477	2.844539	2.844601	2.844663	2.844726	2.844788	2.844851	2.844912	2.844974	2.845036	62
700	2.845098	2.845160	2.845222	2.845284	2.845346	2.845408	2.845470	2.845532	2.845594	2.845656	62
701	2.845718	2.845780	2.845842	2.845902	2.845966	2.846028	2.846090	2.846151	2.846213	2.846275	62
702	2.846337	2.846399	2.846461	2.846523	2.846584	2.846646	2.846708	2.846770	2.846832	2.846893	62
703	2.846955	2.847017	2.847079	2.847141	2.847202	2.847264	2.847326	2.847388	2.847449	2.847511	62
704	2.847573	2.847634	2.847696	2.847758	2.847819	2.847881	2.847943	2.848004	2.848066	2.848127	62
705	2.848189	2.848251	2.848312	2.848374	2.848435	2.848497	2.848559	2.848620	2.848682	2.848743	62
706	2.848805	2.848866	2.848928	2.848989	2.849051	2.849112	2.849174	2.849235	2.849296	2.849358	61
707	2.849419	2.849481	2.849542	2.849604	2.849665	2.849726	2.849788	2.849849	2.849911	2.849972	61
708	2.850033	2.850095	2.850156	2.850217	2.850279	2.850340	2.850401	2.850462	2.850524	2.850585	61
709	2.850646	2.850707	2.850769	2.850830	2.850891	2.850952	2.851014	2.851075	2.851136	2.851197	61
710	2.851258	2.851319	2.851381	2.851442	2.851503	2.851564	2.851625	2.851686	2.851747	2.851808	61
711	2.851870	2.851931	2.851992	2.852053	2.852114	2.852175	2.852236	2.852297	2.852358	2.852419	61
712	2.852480	2.852541	2.852602	2.852663	2.852724	2.852785	2.852846	2.852907	2.852968	2.853029	61
713	2.853089	2.853150	2.853211	2.853272	2.853333	2.853394	2.853455	2.853516	2.853576	2.853637	61
714	2.853698	2.853759	2.853820	2.853881	2.853941	2.854002	2.854063	2.854124	2.854184	2.854245	61
715	2.854306	2.854367	2.854427	2.854488	2.854549	2.854610	2.854670	2.854731	2.854792	2.854852	61
716	2.854913	2.854974	2.855034	2.855095	2.855156	2.855216	2.855277	2.855337	2.855398	2.855459	61
717	2.855519	2.855580	2.855640	2.855701	2.855761	2.855822	2.855882	2.855943	2.856003	2.856064	61
718	2.856124	2.856185	2.856245	2.856306	2.856466	2.856427	2.856487	2.856548	2.856608	2.856668	60
719	2.856729	2.856789	2.856850	2.856910	2.856970	2.857031	2.857091	2.857151	2.857212	2.857272	60
720	2.857332	2.857393	2.857453	2.857513	2.857574	2.857634	2.857694	2.857754	2.857815	2.857875	60
721	2.857935	2.857995	2.858056	2.858116	2.858176	2.858236	2.858296	2.858357	2.858417	2.858477	60
722	2.858537	2.858597	2.858657	2.858718	2.858778	2.858838	2.858898	2.858958	2.859018	2.859078	60
723	2.859138	2.859198	2.859258	2.859318	2.859378	2.859438	2.859499	2.859559	2.859619	2.859679	60
724	2.859739	2.859798	2.859858	2.859918	2.859978	2.860038	2.860098	2.860158	2.860218	2.860278	60
725	2.860338	2.860398	2.860458	2.860518	2.860578	2.860637	2.860697	2.860757	2.860817	2.860877	60
726	2.860937	2.860996	2.861056	2.861116	2.861176	2.861236	2.861295	2.861355	2.861415	2.861475	60
727	2.861534	2.861594	2.861654	2.861714	2.861773	2.861833	2.861893	2.861952	2.862012	2.862072	60
728	2.862131	2.862191	2.862251	2.862310	2.862370	2.862430	2.862489	2.862549	2.862608	2.862668	60
729	2.862727	2.862787	2.862847	2.862906	2.862966	2.863025	2.863085	2.863144	2.863204	2.863263	60
730	2.863323	2.863382	2.863442	2.863501	2.863561	2.863620	2.863680	2.863739	2.863798	2.863858	59
731	2.863917	2.863977	2.864036	2.864096	2.864155	2.864214	2.864274	2.864333	2.864392	2.864452	59
732	2.864511	2.864570	2.864630	2.864689	2.864748	2.864808	2.864867	2.864926	2.864985	2.865045	59
733	2.865104	2.865163	2.865222	2.865282	2.865341	2.865400	2.865459	2.865518	2.865578	2.865637	59
734	2.865696	2.865755	2.865814	2.865873	2.865933	2.865992	2.866051	2.866110	2.866169	2.866228	59
735	2.866287	2.866346	2.866405	2.866465	2.866524	2.866583	2.866642	2.866701	2.866760	2.866819	59
736	2.866878	2.866937	2.866996	2.867055	2.867114	2.867173	2.867232	2.867291	2.867350	2.867409	59
737	2.867467	2.867526	2.867585	2.867644	2.867703	2.867762	2.867821	2.867880	2.867939	2.867997	59
738	2.868056	2.868115	2.868174	2.868233	2.868292	2.868350	2.868409	2.868468	2.868527	2.868586	59
739	2.868644	2.868703	2.868762	2.868821	2.868879	2.868938	2.868997	2.869056	2.869114	2.869173	59
740	2.869232	2.869290	2.869349	2.869408	2.869466	2.869525	2.869584	2.869642	2.869701	2.869760	59
741	2.869818	2.869877	2.869935	2.869994	2.870053	2.870111	2.870170	2.870228	2.870287	2.870345	59
742	2.870404	2.870462	2.870521	2.870579	2.870638	2.870696	2.870755	2.870813	2.870872	2.870930	58
743	2.870989	2.871047	2.871106	2.871164	2.871223	2.871281	2.871339	2.871398	2.871456	2.871515	58
744	2.871573	2.871631	2.871690	2.871748	2.871806	2.871865	2.871923	2.871981	2.872040	2.872098	58

N°	0	1	2	3	4	5	6	7	8	9	Diff.
745	2.872156	2.872215	2.872273	2.872331	2.872389	2.872448	2.872506	2.872564	2.872622	2.872681	58
746	2.872739	2.872797	2.872855	2.872913	2.872972	2.873030	2.873088	2.873146	2.873204	2.873262	58
747	2.873321	2.873379	2.873437	2.873495	2.873553	2.873611	2.873669	2.873727	2.873785	2.873843	58
748	2.873902	2.873960	2.874018	2.874076	2.874134	2.874192	2.874250	2.874308	2.874366	2.874424	58
749	2.874482	2.874540	2.874598	2.874656	2.874714	2.874772	2.874830	2.874887	2.874945	2.875003	58
750	2.875061	2.875119	2.875177	2.875235	2.875293	2.875351	2.875409	2.875466	2.875524	2.875582	58
751	2.875640	2.875698	2.875756	2.875813	2.875871	2.875929	2.875987	2.876044	2.876102	2.876160	58
752	2.876218	2.876276	2.876333	2.876391	2.876449	2.876506	2.876564	2.876622	2.876680	2.876737	58
753	2.876795	2.876853	2.876910	2.876968	2.877026	2.877083	2.877141	2.877198	2.877256	2.877314	58
754	2.877371	2.877429	2.877486	2.877544	2.877603	2.877659	2.877717	2.877774	2.877832	2.877889	58
755	2.877943	2.878004	2.878062	2.878119	2.878177	2.878234	2.878292	2.878349	2.878407	2.878464	57
756	2.878522	2.878579	2.878637	2.878694	2.878751	2.878809	2.878866	2.878922	2.878981	2.879038	57
757	2.879096	2.879153	2.879211	2.879268	2.879325	2.879383	2.879440	2.879497	2.879555	2.879612	57
758	2.879669	2.879726	2.879784	2.879841	2.879898	2.879956	2.880010	2.880070	2.880127	2.880185	57
759	2.880242	2.880299	2.880356	2.880413	2.880471	2.880528	2.880585	2.880642	2.880699	2.880756	57
760	2.880814	2.880871	2.880928	2.880985	2.881042	2.881099	2.881156	2.881213	2.881270	2.881328	57
761	2.881385	2.881442	2.881499	2.881556	2.881613	2.881670	2.881727	2.881784	2.881841	2.881898	57
762	2.881955	2.882012	2.882069	2.882126	2.882183	2.882240	2.882297	2.882354	2.882411	2.882408	57
763	2.882524	2.882581	2.882638	2.882695	2.882752	2.882809	2.882866	2.882923	2.882980	2.883036	57
764	2.883093	2.883150	2.883207	2.883264	2.883321	2.883377	2.883434	2.883491	2.883548	2.883605	57
765	2.883661	2.883718	2.883775	2.883832	2.883889	2.883945	2.884002	2.884059	2.884115	2.884172	57
766	2.884229	2.884285	2.884342	2.884399	2.884455	2.884514	2.884569	2.884625	2.884682	2.884739	57
767	2.884795	2.884852	2.884909	2.884965	2.885022	2.885078	2.885135	2.885191	2.885248	2.885305	57
768	2.885361	2.885418	2.885474	2.885531	2.885587	2.885644	2.885700	2.885757	2.885813	2.885870	57
769	2.885926	2.885983	2.886039	2.886096	2.886152	2.886209	2.886265	2.886321	2.886378	2.886434	56
770	2.886490	2.886547	2.886603	2.886660	2.886716	2.886773	2.886829	2.886885	2.886942	2.886998	56
771	2.887054	2.887111	2.887167	2.887223	2.887280	2.887336	2.887392	2.887448	2.887505	2.887561	56
772	2.887617	2.887673	2.887730	2.887786	2.887842	2.887898	2.887955	2.888011	2.888067	2.888123	56
773	2.888179	2.888236	2.888292	2.888348	2.888404	2.888460	2.888516	2.888573	2.888629	2.888685	56
774	2.888741	2.888797	2.888853	2.888909	2.888965	2.889021	2.889077	2.889133	2.889190	2.889246	56
775	2.889302	2.889358	2.889414	2.889470	2.889526	2.889582	2.889638	2.889694	2.889750	2.889806	56
776	2.889862	2.889918	2.889974	2.890030	2.890086	2.890141	2.890197	2.890253	2.890309	2.890365	56
777	2.890421	2.890477	2.890533	2.890589	2.890644	2.890700	2.890755	2.890812	2.890668	2.890924	56
778	2.890980	2.891035	2.891091	2.891147	2.891203	2.891259	2.891314	2.891370	2.891426	2.891482	56
779	2.891537	2.891593	2.891649	2.891705	2.891760	2.891816	2.891872	2.891927	2.891983	2.892039	56
780	2.892095	2.892150	2.892206	2.892262	2.892317	2.892373	2.892428	2.892484	2.892540	2.892595	56
781	2.892651	2.892707	2.892762	2.892818	2.892873	2.892929	2.892985	2.893040	2.893096	2.893151	56
782	2.893207	2.893262	2.893318	2.893373	2.893429	2.893484	2.893540	2.893595	2.893651	2.893706	56
783	2.893762	2.893717	2.893873	2.893928	2.893984	2.894039	2.894094	2.894150	2.894205	2.894261	55
784	2.894316	2.894371	2.894427	2.894482	2.894538	2.894593	2.894648	2.894704	2.894759	2.894814	55
785	2.894870	2.894925	2.894980	2.895036	2.895091	2.895146	2.895201	2.895257	2.895312	2.895367	55
786	2.895422	2.895478	2.895533	2.895588	2.895643	2.895699	2.895754	2.895809	2.895864	2.895919	55
787	2.895975	2.896030	2.896085	2.896140	2.896195	2.896251	2.896306	2.896361	2.896416	2.896471	55
788	2.896526	2.896581	2.896636	2.896691	2.896747	2.896802	2.896857	2.896912	2.896967	2.897022	55
789	2.897077	2.897132	2.897187	2.897242	2.897297	2.897352	2.897407	2.897462	2.897517	2.897572	55
790	2.897627	2.897682	2.89773	2.897792	2.897847	2.897902	2.897957	2.898012	2.898067	2.898122	55
791	2.898176	2.898231	2.89828	2.898341	2.898396	2.898451	2.898506	2.898561	2.898615	2.898670	55
792	2.898725	2.898780	2.89883	2.898890	2.898944	2.898999	2.899054	2.899109	2.899164	2.899218	55
793	2.899273	2.899328	2.89938	2.899437	2.899492	2.899547	2.899602	2.899656	2.899711	2.899766	55
794	2.899820	2.899875	2.89993	2.899985	2.900039	2.900094	2.900149	2.900203	2.900258	2.900312	55
795	2.900367	2.900422	2.90047	2.900531	2.900586	2.900640	2.900695	2.900749	2.900804	2.900858	55
796	2.900913	2.900968	2.901022	2.901077	2.901131	2.901186	2.901240	2.901295	2.901349	2.901404	55
797	2.901458	2.901513	2.901567	2.901622	2.901676	2.901731	2.901785	2.901840	2.901894	2.901948	54
798	2.902003	2.902057	2.902112	2.902166	2.902220	2.902275	2.902329	2.902384	2.902438	2.902492	54
799	2.902547	2.902601	2.902655	2.902710	2.902764	2.902818	2.902873	2.902927	2.902981	2.903036	54

N°	0	1	2	3	4	5	6	7	8	9	Diff.
800	2.903090	2.903144	2.903198	2.903253	2.903307	2.903361	2.903416	2.903470	2.903524	2.903578	54
801	2.903632	2.903687	2.903741	2.903795	2.903849	2.903903	2.903958	2.904012	2.904066	2.904120	54
802	2.904174	2.904228	2.904283	2.904337	2.904391	2.904445	2.904499	2.904553	2.904607	2.904661	54
803	2.904715	2.904770	2.904824	2.904878	2.904932	2.904986	2.905040	2.905094	2.905148	2 905202	54
804	2.905256	2.905310	2.905364	2.905418	2.905472	2.905526	2.905580	2.905634	2.905688	2.905742	54
405	2.905796	2.905850	2.905904	2.905958	2.906012	2.906065	2.906119	2.906173	2.906227	2.906281	54
806	2.906335	2.906389	2.906443	2.906497	2.906550	2.906604	2.906658	2.906712	2.906766	2.906820	54
807	2.906873	2.906927	2.906981	2.907035	2.907089	2.907142	2.907196	2.907250	2.907304	2.907358	54
808	2.907411	2.907465	2.907519	2.907573	2.907626	2.907680	2.907734	2.907787	2.907841	2.907895	54
809	2.907948	2.908002	2.908056	2.908109	2.908163	2.908217	2.908270	2.908324	2.908378	2.908431	54
810	2.908485	2.908539	2.908592	2.908646	2.908699	2.908753	2.908807	2.908860	2.908914	2.908967	54
811	2.909021	2.909074	2.909128	2.909181	2.909235	2.909288	2.909342	2.909395	2.909449	2.909502	54
812	2.909556	2.909609	2.909663	2.909716	2.909770	2.909823	2.909877	2.909930	2.909984	2.910037	53
813	2.910090	2.910144	2.910197	2.910251	2.910304	2.910358	2.910411	2.910464	2.910518	2.910571	53
814	2.910624	2.910678	2.910731	2.910784	2.910838	2.910891	2.910944	2.910998	2 911051	2.911104	53
815	2.911158	2.911211	2.911264	2.911317	2.911371	2.911424	2.911477	2.911530	2.911584	2.911637	53
816	2.911690	2.911743	2.911797	2.911850	2.911903	2.911956	2.912009	2.912063	2.912116	2.912169	53
817	2.912222	2.912275	2.912328	2.912381	2.912435	2.912488	2.912541	2.912594	2.912647	2.912700	53
818	2.912753	2 912806	2.912859	2.912912	2.912966	2.913019	2.913072	2.913125	2.913178	2.913231	53
819	2.913284	2.913337	2.913390	2.913443	2.913496	2.913549	2.913602	2.913655	2.913708	2.913761	53
820	2.913814	2.913867	2.913920	2.913973	2.914026	2.914079	2.914131	2.914184	2.914237	2.914290	53
821	2.914343	2.914396	2.914449	2.914502	2.914555	2.914608	2.914660	2.914713	2.914766	2.914819	53
822	2.914872	2.914925	2.914977	2.915030	2.915083	2.915136	2.915189	2.915241	2.915294	2.915347	53
823	2.915400	2.915453	2.915505	2.915558	2.915611	2.915664	2.915716	2.915769	2.915822	2.915874	53
824	2.915927	2.915980	2.916033	2.916085	2.916138	2.916191	2.916243	2.916296	2.916349	2.916401	53
825	2.916454	2.916507	2.916559	2.916612	2.916664	2.916717	2.916770	2.916822	2.916875	2.916927	53
826	2.916980	2.917033	2.917085	2.917138	2.917190	2.917243	2.917295	2.917348	2.917400	2.917453	53
827	2.917505	2.917558	2.917610	2.917663	2.917715	2.917768	2.917820	2.917873	2.917925	2.917978	52
828	2.918030	2.918083	2.918135	2.918188	2.918240	2.918292	2.918345	2.918397	2.918450	2.918502	52
829	2.918554	2.918607	2.918659	2.918712	2.918764	2.918816	2.918869	2.918921	2.918973	2.919026	52
830	2.919078	2.919130	2.919183	2.919235	2.919287	2.919340	2.919392	2.919444	2.919496	2.919549	52
831	2.919601	2.919653	2.919705	2.919758	2.919810	2.919862	2.919914	2.919967	2.920019	2.920071	52
832	2.920123	2.920175	2.920228	2.920280	2.920332	2.920384	2.920436	2.920489	2.920545	2.920593	52
833	2.920645	2.920697	2.920749	2.920801	2.920853	2.920906	2.920958	2.921010	2.921062	2.921114	52
834	2.921166	2.921218	2.921270	2.921322	2.921374	2.921426	2.921478	2.921530	2.921582	2.921634	52
835	2.921686	2.921738	2.921790	2.921842	2.921894	2.921946	2.921998	2.922050	2.922102	2.922154	52
836	2.922206	2.922258	2.922310	2.922362	2.922414	2.922466	2.922518	2.922570	2.922622	2.922674	52
837	2.922725	2.922777	2.922829	2.922881	2.922933	2.922985	2.923037	2.923088	2.923140	2.923192	52
838	2.923244	2.923296	2.923348	2.923399	2.923451	2.923503	2.923555	2.923607	2.923658	2.923710	52
839	2.923762	2.923814	2.923865	2.923917	2.923969	2.924021	2.924072	2.924124	2.924176	2.924228	52
840	2.924279	2.924331	2.924383	2.924434	2.924486	2.924538	2.924589	2.924641	2.924693	2.924744	52
841	2.924796	2.924848	2.924899	2.924951	2.925002	2.925054	2.925106	2.925157	2.925209	2.925260	52
842	2.925312	2.925364	2.925415	2.925467	2.925518	2.925570	2.925621	2.925673	2.925724	2.925776	52
843	2.925828	2.925879	2.925930	2.925982	2.926034	2.926085	2.926137	2.926188	2.926239	2.926291	51
844	2.926342	2.926394	2.926445	2.926497	2.926548	2.926600	2.926951	2.926702	2.926754	2.926805	51
845	2.926857	2.926908	2.926959	2.927011	2.927062	2.927114	2.927165	2.927216	2.927268	2.927319	51
846	2.927370	2.927422	2.927473	2.927524	2.927576	2.927627	2.927678	2.927730	2.927781	2.927832	51
847	2.927883	2.927935	2.927986	2.928037	2.928088	2.928140	2.928191	2.928242	2.928293	2.928345	51
848	2.928396	2.928447	2.928498	2.928549	2.928601	2.928652	2.928703	2.928754	2.928805	2.928856	51
849	2.928908	2.928959	2.929010	2.929061	2.929112	2.929163	2.929214	2.929266	2.929317	2.929368	51
850	2.929419	2.929470	2.929521	2.929572	2.929623	2.929674	2.929725	2.929776	2.929827	2.929878	51
851	2.929930	2.929981	2.930032	2.930083	2.930134	2.930185	2.930236	2.930287	2.930338	2.930389	51
852	2.930440	2.930491	2.930540	2.930592	2.930643	2.930694	2.930745	2.930796	2.930847	2.930898	51
853	2.930949	2.931000	2.931051	2.931102	2.931153	2.931205	2.931254	2.931305	2.931356	2.931407	51
854	2.931458	2.931509	2.931560	2.931610	2.931661	2.931712	2.931763	2.931814	2.931864	2.931915	51

N°	0	1	2	3	4	5	6	7	8	9	Diff.
855	2.931966	2.932017	2.932068	2.932118	2.932169	2.932220	2.932271	2.932321	2.932372	2.932423	51
856	2.932474	2.932524	2.932575	2.932626	2.932677	2.932727	2.932778	2.932829	2.932879	2.932930	51
857	2.932981	2.933033	2.933082	2.933133	2.933183	2.933234	2.933285	2.933335	2.933386	2.933437	51
858	2.933487	2.933538	2.933588	2.933639	2.933690	2.933740	2.933791	2.933841	2.933892	2.933943	51
859	2.933993	2.934044	2.934094	2.934145	2.934195	2.934246	2.934296	2.934347	2.934397	2.934448	51
860	2.934498	2.934549	2.934599	2.934650	2.934700	2.934751	2.934801	2.934852	2.934902	2.934953	50
861	2.935003	2.935054	2.935104	2.935154	2.935205	2.935255	2.935306	2.935356	2.935406	2.935457	50
862	2.935507	2.935558	2.935608	2.935658	2.935709	2.935759	2.935809	2.935860	2.935910	2.935960	50
863	2.936011	2.936061	2.936111	2.936162	2.936212	2.936262	2.936313	2.936363	2.936413	2.936463	50
864	2.936514	2.936564	2.936614	2.936664	2.936715	2.936765	2.936815	2.936865	2.936916	2.936969	50
865	2.937016	2.937066	2.937116	2.937167	2.937217	2.937267	2.937317	2.937367	2.937418	2.937468	50
866	2.937518	2.937568	2.937618	2.937668	2.937718	2.937769	2.937819	2.937869	2.937919	2.937969	50
867	2.938019	2.938069	2.938119	2.938169	2.938219	2.938269	2.938319	2.938370	2.938420	2.938470	50
868	2.938520	2.938570	2.938620	2.938670	2.938720	2.938770	2.938820	2.938870	2.938920	2.938970	50
869	2.939020	2.939070	2.939120	2.939170	2.939220	2.939270	2.939319	2.939369	2.939419	2.939469	50
870	2.939519	2.939569	2.939619	2.939669	2.939719	2.939769	2.939819	2.939868	2.939918	2.939968	50
871	2.940018	2.940068	2.940118	2.940168	2.940218	2.940267	2.940317	2.940366	2.940417	2.940467	50
872	2.940516	2.940566	2.940616	2.940666	2.940716	2.940765	2.940815	2.940865	2.940915	2.940964	50
873	2.941014	2.941064	2.941114	2.941163	2.941213	2.941263	2.941313	2.941362	2.941412	2.941462	50
874	2.941511	2.941561	2.941611	2.941660	2.941710	2.941760	2.941809	2.941859	2.941909	2.941958	50
875	2.942008	2.942058	2.942107	2.942157	2.942206	2.942256	2.942300	2.942355	2.942405	2.942454	50
876	2.942504	2.942554	2.942603	2.942653	2.942702	2.942752	2.942801	2.942851	2.942900	2.942950	50
877	2.943000	2.943049	2.943099	2.943148	2.943198	2.943247	2.942397	2.943346	2.943397	2.944445	49
878	2.943494	2.943544	2.943593	2.943643	2.943692	2.943742	2.943791	2.943841	2.943890	2.943939	49
879	2.943989	2.944038	2.944088	2.944137	2.944186	2.944236	2.944285	2.944335	2.944384	2.944433	49
880	2.944483	2.944532	2.944581	2.944631	2.944690	2.944729	2.944779	2.944828	2.944877	2.944927	49
881	2.944976	2.945025	2.945074	2.945124	2.945173	2.945222	2.945272	2.945321	2.945370	2.945419	49
882	2.945469	2.945518	2.945567	2.945616	2.945665	2.945715	2.945764	2.945813	2.945863	2.945911	49
883	2.945961	2.946010	2.946059	2.946108	2.946157	2.946207	2.946256	2.946305	2.946354	2.946403	49
884	2.946452	2.946501	2.946550	2.946600	2.946649	2.946698	2.946747	2.946796	2.946845	2.946894	49
885	2.946943	2.946992	2.947041	2.947090	2.947139	2.947189	2.947238	2.947287	2.947336	2.947385	49
886	2 947434	2.947483	2.947532	2.947581	2.947630	2.947679	2.947728	2.947777	2.947826	2.947875	49
887	2.947924	2.947973	2.948021	2.948070	2.948119	2.948168	2.948217	2.948266	2.948315	2.948364	49
888	2.948413	2.948462	2.948511	2.948560	2.948608	2.948657	2.948700	2.948755	2.948804	2.948853	49
889	2.948902	2.948951	2.948999	2.949048	2.949097	2.949146	2.949195	2.949244	2.949292	2.949341	49
890	2.949390	2.949439	2.949488	2.949539	2.949585	2.949633	2.949683	2.949731	2.949780	2.949829	49
891	2.949078	2.949926	2.949975	2.950023	2.950073	2.950121	2.950170	2.950219	2.950267	2.950316	49
892	2.950365	2.950413	2.950462	2.950511	2.950560	2.950608	2.950657	2.950705	2.950754	2.950803	49
893	2.950859	2.950900	2.950946	2.950997	2.951047	2.951095	2.951143	2.951192	2.951240	2 951289	49
894	2 951337	2.951386	2.951435	2.951483	2.951532	2.951580	2.951629	2.951677	2.951726	2.951774	49
895	2.951823	2.951872	2.951920	2.951969	2.952017	2.952066	2.952114	2.952163	2.952211	2.952259	48
896	2.952328	2.952356	2.952405	2.952453	2.952502	2.952550	2.952699	2.952647	2.952696	2.952744	48
897	2.952792	2.952841	2 952889	2.952938	2.952986	2.953034	2 953083	2.953131	2.953180	2.953228	48
898	2.953276	2.953325	2.953373	2.953421	2.953470	2.953518	2.953566	2.953615	2.953663	2.953711	48
899	2 953760	2.953808	2.953856	2.953905	2.953953	2.954001	2.954049	2.954098	2.954246	2.954194	48
900	2.954242	2.954291	2 954339	2.954387	2.954435	2.954484	2.954532	2.954580	2.954628	2 954677	48
901	2.954725	2.954773	2.954811	2.954869	2.954918	2.954966	2.955014	2.955062	2.955110	2.955185	48
902	2.955206	2.955255	2.955303	2.955351	2.955399	2.955447	2.955495	2.955543	2.955591	2.955640	48
903	2.955688	2.955736	2.955784	2.955832	2.955880	2.955928	2.955976	2.956024	2.956072	2.956120	48
904	2.956168	2.956216	2.956264	2.956312	2.956360	2.956409	2.95645	2 956505	2.956553	2.956601	48
905	2.956649	2.956697	2.956744	2.956792	2.956840	2.956888	2 956936	2.956984	2.957032	2.957080	48
906	2.957128	2.957176	2.957224	2 957272	2.957320	2.957368	2.957416	2.957462	2.957511	2.957559	48
907	2.957607	2.957655	2.957703	2.957751	2.957799	2.957847	2.957894	2.957942	2.957990	2.958038	48
908	2.958086	2.958134	2.958181	2.958229	2.958277	2.958325	2.958373	2.958420	2.958468	2.958516	48
909	2.958564	2.958612	2.958659	2.958707	2.958755	2.958803	2.958850	2.958898	2.958946	2.958994	48

N°	0	1	2	3	4	5	6	7	8	9	Diff.
910	2.959041	2.959089	2.959137	2.959184	2.959232	2.959280	2.959328	2.959375	2.959423	2.959471	48
911	2.959518	2.959566	2.959614	2.959661	2.959709	2.959757	2.959804	2.959852	2.959900	2.959947	48
912	2.959995	2.960042	2.960090	2.960138	2.960185	2.960233	2.960280	2.960328	2.960376	2.960423	48
913	2.960471	2.960518	2.960566	2.960613	2.960661	2.960708	2.960756	2.960804	2.960851	2.960899	48
914	2.960946	2.960994	2.961041	2.961089	2.961136	2.961184	2.961231	2.961279	2.961326	2.961374	47
915	2.961421	2.961468	2.961516	2.961563	2.961611	2.961658	2.961706	2.961753	2.961801	2.961848	47
916	2.961895	2.961943	2.961990	2.962038	2.962085	2.962132	2.962180	2.962227	2.962275	2.962322	47
917	2.962369	2.962417	2.962464	2.962511	2.962559	2.962606	2.962653	2.962701	2.962748	2.962795	47
918	2.962843	2.962890	2.962927	2.962985	2.963032	2.963079	2.963126	2.963174	2.963221	2.963268	47
919	2.963315	2.963363	2.963410	2.963457	2.963504	2.963552	2.963599	2.963646	2.963693	2.963741	47
920	2.963788	2.963835	2.963882	2.963929	2.963977	2.964024	2.964071	2.964118	2.964165	2.964212	47
921	2.964260	2.964307	2.964354	2.964401	2.964448	2.964495	2.964542	2.964590	2.964637	2.964684	47
922	2.964731	2.964778	2.964825	2.964872	2.964919	2.964966	2.965013	2.965060	2.965108	2.965155	47
923	2.965202	2.965249	2.965296	2.965343	2.965390	2.965437	2.965484	2.965531	2.965578	2.965625	47
924	2.965672	2.965719	2.965766	2.965813	2.965860	2.965907	2.965954	2.966001	2.966048	2.966095	47
925	2.966142	2.966189	2.966236	2.966283	2.966329	2.966376	2.966423	2.966470	2.966511	2.966564	47
926	2.966611	2.966658	2.966705	2.966752	2.966798	2.966845	2.966892	2.966939	2.966986	2.967033	47
927	2.967080	2.967127	2.967173	2.967220	2.967267	2.967314	2.967361	2.967408	2.967454	2.967501	47
928	2.967548	2.967595	2.967642	2.967688	2.967735	2.967782	2.967829	2.967875	2.967922	2.967969	47
929	2.968016	2.968062	2.968107	2.968156	2.968203	2.968249	2.968296	2.968343	2.968389	2.968436	47
930	2.968483	2.968530	2.968576	2.968623	2.968670	2.968716	2.968763	2.968810	2.968856	2.968903	47
931	2.968950	2.968996	2.969042	2.969090	2.969136	2.969183	2.969229	2.969276	2.969323	2.969369	47
932	2.969416	2.969462	2.969509	2.969556	2.969602	2.969649	2.969695	2.969742	2.969788	2.969835	47
933	2.969882	2.969928	2.969975	2.970031	2.970068	2.970114	2.970161	2.970207	2.970254	2.970300	47
934	2.970347	2.970393	2.970440	2.970486	2.970533	2.970579	2.970626	2.970672	2.970719	2.970765	46
935	2.970812	2.970858	2.970904	2.970951	2.970997	2.971044	2.971090	2.971137	2.971183	2.971224	46
936	2.971276	2.971322	2.971369	2.971415	2.971461	2.971508	2.971554	2.971600	2.971647	2.971693	46
937	2.971740	2.971786	2.971832	2.971879	2.971925	2.971971	2.972018	2.972064	2.972110	2.972156	46
938	2.972203	2.972249	2.972295	2.972342	2.972388	2.972434	2.972480	2.972527	2.972573	2.972619	46
939	2.972665	2.972712	2.972758	2.972804	2.972851	2.972897	2.972945	2.972989	2.973035	2.973082	46
940	2.973128	2.973174	2.973220	2.973260	2.973313	2.973359	2.973405	2.973451	2.973497	2.973543	46
941	2.973590	2.973636	2.973682	2.973728	2.973774	2.973820	2.973866	2.973913	2.973959	2.974005	46
942	2.975051	2.974097	2.974343	2.974189	2.974235	2.974281	2.974327	2.974373	2.974420	2.974466	46
943	2.974512	2.974558	2.974604	2.974650	2.974696	2.974742	2.974788	2.974834	2.974880	2.974926	46
944	2.974972	2.975018	2.975064	2.975110	2.975156	2.975202	2.975248	2.975294	2.975340	2.975386	46
945	2.975432	2.975478	2.975524	2.975570	2.975616	2.975661	2.975707	2.975753	2.975799	2.975845	46
946	2.975890	2.975937	2.975983	2.976029	2.976075	2.976121	2.976166	2.976212	2.976258	2.976304	46
947	2.976350	2.976396	2.976442	2.976487	2.976533	2.976579	2.976625	2.976671	2.976717	2.976762	46
948	2.976808	2.976854	2.976900	2.976940	2.976991	2.977037	2.977083	2.977129	2.977175	2.977220	46
949	2.977266	2.977312	2.977358	2.977403	2.977449	2.977495	2.977541	2.977586	2.977632	2.977678	46
950	2.977724	2.977769	2.977815	2.977861	2.976906	2.977952	2.977998	2.978043	2.978089	2.978135	46
951	2.978180	2.978226	2.978272	2.978317	2.978363	2.978409	2.978454	2.978500	2.978546	2.978591	46
952	2.978637	2.978683	2.978728	2.978774	2.978819	2.978865	2.978911	2.978956	2.979002	2.979047	46
953	2.979093	2.979138	2.979184	2.979230	2.979275	2.979321	2.979366	2.979412	2.979457	2.979503	46
954	2.979548	2.979594	2.979639	2.979685	2.979730	2.979776	2.979821	2.979867	2.979912	2.979958	46
955	2.980003	2.980049	2.980094	2.980140	2.980185	2.980231	2.980276	2.980372	2.980367	2.980412	45
956	2.980458	2.980503	2.980549	2.980594	2.980640	2.980685	2.980730	2.980776	2.980821	2.980867	45
957	2.980912	2.980957	2.981003	2.981048	2.981093	2.981139	2.981184	2.981229	2.981275	2.981320	45
958	2.981365	2.981411	2.981456	2.981501	2.981547	2.981592	2.981637	2.981683	2.981728	2.981773	45
959	2.981819	2.981864	2.981909	2.981954	2.982000	2.982045	2.982090	2.982135	2.982181	2.982226	45
960	2.982271	2.982316	2.982362	2.982407	2.982452	2.982497	2.982543	2.982588	2.982633	2.982678	45
961	2.982723	2.982769	2.982814	2.982859	2.982904	2.982949	2.982994	2.983040	2.983085	2.983130	45
962	2.983175	2.983220	2.983265	2.983310	2.983356	2.983401	2.983446	2.983491	2.983536	2.983581	45
963	2.983626	2.983671	2.983716	2.983762	2.983807	2.983852	2.983897	2.983942	2.983987	2.984032	45
964	2.984077	2.984122	2.984167	2.984212	2.984257	2.984302	2.984347	2.984392	2.984437	2.984482	45

LOGARITHMS.

N°	0	1	2	3	4	5	6	7	8	9	Dif.
965	2.984527	2.984572	2.984617	2.984662	2.984707	2.984752	2.984797	2.984842	2.984887	2.984932	45
966	2.984977	2.985022	2.985067	2.985112	2.985157	2.985202	2.985247	2.985292	2.985337	2.985382	45
967	2.985426	2.985471	2.985516	2.985561	2.985606	2.985651	2.985696	2.985741	2.985786	2.985830	45
968	2.985875	2.985920	2.985965	2.986010	2.986055	2.986100	2.986144	2.986189	2.986234	2.986279	45
969	2.986324	2.986369	2.986413	2.986458	2.986503	2 986548	2.986593	2.986637	2.986682	2.986727	45
970	2.986772	2.986816	2.986861	2.986906	2.986951	2.986995	2.987040	2.987085	2.987130	2.987174	45
971	2.987219	2 987264	2.987309	2.987353	2.987398	2.987443	2.987487	2.987532	2.987577	2.987622	45
972	2.987666	2.987711	2.987756	2.987800	2.987845	2.987890	2.987934	2.987979	2.988024	2.988068	45
973	2.988113	2.988157	2.988202	2.988247	2.988291	2.988336	2.988381	2.988425	2.988470	2.988514	45
974	2.988559	2.988603	2.988648	2.988693	2.988737	2.988782	2.988826	2.988871	2.988915	2.988960	45
975	2.989005	2.989049	2.989094	2.989138	2.989183	2.989227	2.989272	2.989316	2.989361	2.989405	45
976	2.989450	2.989494	2.989539	2.989583	2.989628	2.989672	2.989717	2.989761	2.989806	2.989850	44
977	2.989895	2.989939	2.989983	2.990028	2.990072	2.990117	2.990161	2.990206	2.990250	2.990294	44
978	2.990339	2.990383	2.990428	2.990472	2.990516	2.990561	2.990605	2.990650	2.990694	2.990738	44
979	2.990783	2.990827	2.990871	2.990916	2.990960	2.991004	2.991049	2.991093	2.991137	2.991182	44
980	2.991226	2.991270	2.991315	2.991359	2.991403	2.991448	2.991492	2.991536	2.991580	2.991625	44
981	2.991669	2.991713	2.991757	2.991802	2.991846	2.991890	2.991934	2.991979	2.992023	2.992067	44
982	2.992111	2.992156	2.992200	2.992244	2.992288	2.992333	2.992377	2.992421	2.992465	2.992509	44
983	2.992553	2.992598	2.992642	2.992686	2.992730	2.992774	2.992818	2.992863	2.992907	2.992951	44
984	2.992995	2.993039	2.993083	2.993127	2.993172	2.993216	2.993260	2.993304	2.993348	2.993392	44
985	2 993436	2.993480	2.993524	2.993568	2.993613	2.993657	2.993701	2.993745	2.993789	2.993835	44
986	2.993877	2.993921	2.993965	2.994009	2.994053	2.994097	2.994141	2.994185	2.994229	2.994273	44
987	2.994317	2.994361	2.994405	2.994449	2.994493	2.994537	2.994581	2.994625	2.994669	2.994713	44
988	2.994757	2.994801	2.994845	2.994889	2.994933	2.994977	2.995021	2.995064	2.995108	2.995152	44
989	2.995196	2.995240	2.995284	2.995328	2.995372	2.995416	2.995460	2.995504	2.995547	2.995591	44
990	2.995635	2.995679	2.995723	2.995767	2.995811	2.995854	2.995898	2.995942	2.995986	2.996030	44
991	2.996074	2.996117	2.996161	2.996205	2.996249	2.996293	2.996336	2.996380	2.996424	2.996468	44
992	2.996512	2.996555	2.996599	2.996643	2.996687	2.996730	2.996774	2.996818	2.996862	2.996905	44
993	2.996949	2.996993	2.997037	2.997080	2.997124	2.997168	2.997212	2.997255	2.997299	2.997343	44
994	2.997386	2.997430	2.997474	2.997517	2.997561	2.997605	2.997648	2.997692	2.997736	2.997779	44
995	2.997823	2.997867	2.997910	2.997954	2.997998	2.998041	2.998085	2.998128	2.998172	2.998216	44
996	2.998259	2.998303	2.998346	2.998390	2.998434	2.998477	2.998521	2.998564	2.998608	2.998652	44
997	2.998695	2.998736	2.998782	2.998826	2.998869	2.998913	2.998956	2.999000	2.999043	2.999087	44
998	2.999130	2.999174	2.999218	2.999261	2.999305	2.999348	2.999392	2.999435	2.999478	2.999522	44
999	2.999565	2.999609	2.999652	2.999696	2.999739	2.999783	2.999826	2.999870	2.999913	2.999957	43

A Logarithmic CANON, or TABLE of Artificial SINES and TANGENTS; the Radius 10,000,000.

Min.	0 Degree				
	Sine	Sine Comp.	Tang.	Tang. Com.	
0	0.0000000	10.0000000	0.0000000	Infinite	60
1	6.4637261	9.9999999	6.4637261	13.5362739	59
2	6.7647561	9.9999999	6.7647562	13.2352438	58
3	6.9408473	9.9999998	6.9408475	13.0591525	57
4	7.0657860	9.9999997	7.0657863	12.9342137	56
5	7.1626960	9.9999995	7.1626964	12.8373036	55
6	7.2418771	9.9999993	7.2418778	12.7581222	54
7	7.3088239	9.9999991	7.3088248	12.6911752	53
8	7.3668157	9.9999988	7.3668169	12.6331831	52
9	7.4179681	9.9999985	7.4179696	12.5820304	51
10	7.4637255	9.9999982	7.4637173	12.5362727	50
11	7.5051181	9.9999978	7.5051203	12.4948797	49
12	7.5429065	9.9999974	7.5429091	12.4570909	48
13	7.5776684	9.9999969	7.5776715	12.4223284	47
14	7.6098530	9.9999964	7.6098566	12.3901434	46
15	7.6398160	9.9999959	7.6398201	12.3601799	45
16	7.6678445	9.9999953	7.6678492	12.3321508	44
17	7.6941733	9.9999947	7.6941786	12.3058214	43
18	7.7189966	9.9999940	7.7190026	12.2709974	42
19	7.7424775	9.9999934	7.7424841	12.2575159	41
20	7.7647537	9.9999927	7.7647610	12.2352390	40
21	7.7859427	9.9999919	7.7859508	12.2140492	39
22	7.8061458	9.9999911	7.8061547	12.1938453	38
23	7.8254507	9.9999903	7.8254604	12.1745396	37
24	7.8439338	9.9999894	7.8439444	12.1560556	36
25	7.8616623	9.9999885	7.8616738	12.1383262	35
26	7.8786953	9.9999876	7.8787077	12.1212923	34
27	7.8960854	9.9999866	7.8950988	12.1049012	33
28	7.9108793	9.9999856	7.9108938	12.0891062	32
29	7.9261190	9.9999845	7.9261344	12.0738656	31
30	7.9408419	9.9999835	7.9408584	12.0591416	30
31	7.9550819	9.9999823	7.9550996	12.0449004	29
32	7.9688698	9.9999812	7.9688886	12.0311114	28
33	7.9822334	9.9999800	7.9822534	12.0177466	27
34	7.9951980	9.9999788	7.9952192	12.0047808	26
35	8.0077867	9.9999775	8.0078092	11.9911908	25
36	8.0200207	9.9999762	8.0200445	11.9799555	24
37	8.0319195	9.9999748	8.0319446	11.9680554	23
38	8.0435009	9.9999735	8.0435274	11.9564726	22
39	8.0547814	9.9999721	8.0548094	11.9451906	21
40	8.0657763	9.9999706	8.0658057	11.9341943	20
41	8.0764997	9.9999691	8.0765306	11.9234694	19
42	8.0869646	9.9999676	8.0869970	11.9130030	18
43	8.0971832	9.9999660	8.0972172	11.9027828	17
44	8.1071669	9.9999644	8.1072025	11.8927975	16
45	8.1169262	9.9999628	8.1169634	11.8830366	15
46	8.1264710	9.9999611	8.1265099	11.8734901	14
47	8.1358104	9.9999594	8.1358510	11.8641490	13
48	8.1449532	9.9999577	8.1449956	11.8550044	12
49	8.1539075	9.9999559	8.1539516	11.8460484	11
50	8.1626808	9.9999541	8.1627267	11.8372733	10
51	8.1712804	9.9999522	8.1713282	11.8286718	9
52	8.1797129	9.9999503	8.1797626	11.8202374	8
53	8.1879848	9.9999484	8.1880364	11.8119636	7
54	8.1961020	9.9999464	8.1961556	11.8038444	6
55	8.2040703	9.9999444	8.2041259	11.7958741	5
56	8.2118949	9.9999424	8.2119526	11.7880474	4
57	8.2195811	9.9999403	8.2196408	11.7803592	3
58	8.2271335	9.9999382	8.2271953	11.7728047	2
59	8.2345568	9.9999360	8.2346208	11.7653792	1
60	8.2418553	9.9999338	8.2419215	11.7580785	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	89 Degrees				

Min.	1 Degree				
	Sine	Sine Comp.	Tang.	Tan. Compt.	
0	8.2418553	9.9999338	8.2419215	11.7580785	60
1	8.2490332	9.9999316	8.2491015	11.7508985	59
2	8.2560943	9.9999294	8.2561649	11.7438351	58
3	8.2630424	9.9999271	8.2631153	11.7368847	57
4	8.2698810	9.9999247	8.2699563	11.7300437	56
5	8.2766136	9.9999254	8.2766912	11.7233088	55
6	8.2832434	9.9999200	8.2833234	11.7166766	54
7	8.2897734	9.9999175	8.2898559	11.7101441	53
8	8.2962067	9.9999150	8.2962917	11.7037083	52
9	8.3025460	9.9999125	8.3026335	11.6973665	51
10	8.3087941	9.9999100	8.3088842	11.6911158	50
11	8.3149536	9.9999074	8.3150462	11.6849538	49
12	8.3210269	9.9999047	8.3211221	11.6788779	48
13	8.3270163	9.9999021	8.3271143	11.6728857	47
14	8.3329243	9.9998994	8.3330249	11.6669751	46
15	8.3387529	9.9998966	8.3388563	11.6611437	45
16	8.3445043	9.9998939	8.3446105	11.6553895	44
17	8.3501805	9.9998911	8.3502895	11.6497105	43
18	8.3557835	9.9998882	8.3558953	11.6441047	42
19	8.3613150	9.9998853	8.3614297	11.6385703	41
20	8.3667769	9.9998824	8.3668945	11.6331055	40
21	8.3721710	9.9998794	8.3722915	11.6277085	39
22	8.3774988	9.9998764	8.3776223	11.6223777	38
23	8.3827620	9.9998734	8.3828886	11.6171114	37
24	8.3879622	9.9998703	8.3880918	11.6119082	36
25	8.3931008	9.9998672	8.3932336	11.6067664	35
26	8.3981793	9.9998641	8.3383152	11.6016848	34
27	8.4031990	9.9998609	8.4033381	11.5966619	33
28	8.4081614	9.9998577	8.4083037	11.5916963	32
29	8.4130676	9.9998544	8.4132132	11.5867868	31
30	8.4179190	9.9998512	8.4180679	11.5819321	30
31	8.4227168	9.9998478	8.4228690	11.5771310	29
32	8.4274621	9.9998445	8.4276176	11.5723824	28
33	8.4321561	9.9998411	8.4323150	11.5676850	27
34	8.4367999	9.9998376	8.4369622	11.5630378	26
35	8.4413944	9.9998342	8.4415603	11.5584397	25
36	8.4459409	9.9998306	8.4461103	11.5538897	24
37	8.4504402	9.9998271	8.4506131	11.5493869	23
38	8.4548934	9.9998235	8.4550699	11.5449301	22
39	8.4593013	9.9998199	8.4594814	11.5405186	21
40	8.4636649	9.9998162	8.4638486	11.5361514	20
41	8.4679850	9.9998125	8.4681725	11.5318275	19
42	8.4722626	9.9998088	8.4724538	11.5275462	18
43	8.4764984	9.9998050	8.4766933	11.5233067	17
44	8.4806932	9.9998012	8.4808920	11.5191080	16
45	8.4848479	9.9997974	8.4850505	11.5149495	15
46	8.4889632	9.9997935	8.4891696	11.5108304	14
47	8.4930398	9.9997896	8.4932502	11.5067498	13
48	8.4970784	9.9997856	8.4972928	11.5027072	12
49	8.5010798	9.9997817	8.5012982	11.4987018	11
50	8.5050447	9.9997776	8.5052671	11.4947329	10
51	8.5089736	9.9997736	8.5092001	11.4907999	9
52	8.5128673	9.9997695	8.5130978	11.4869022	8
53	8.5167264	9.9997653	8.5169610	11.4830387	7
54	8.5205514	9.9997612	8.5207902	11.4792098	6
55	8.5243430	9.9997570	8.5245860	11.4754149	5
56	8.5281017	9.9997527	8.5283490	11.4716510	4
57	8.5318281	9.9997484	8.5320797	11.4679203	3
58	8.5355228	9.9997441	8.5357787	11.4642213	2
59	8.5391863	9.9997398	8.5394466	11.4605534	1
60	8.5428192	9.9997354	8.5430838	11.4569162	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	88 Degrees				

2 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp	
0	8.5428192	9.9997354	8.5430838	11.4569162	60
1	8.5464218	9.9997309	8.5466909	11.4533091	59
2	8.5499948	9.9997265	8.5502683	11.4497317	58
3	8.5535386	9.9997220	8.5538166	11.4461834	57
4	8.5570536	9.9997174	8.5573362	11.4426638	56
5	8.5605404	9.9997128	8.5608276	11.4391724	55
6	8.5639994	9.9997082	8.5642912	11.4357088	54
7	8.5674310	9.9997036	8.5677275	11.4322725	53
8	8.5708357	9.9996989	8.5711368	11.4288632	52
9	8.5742139	9.9996942	8.5745197	11.4254803	51
10	8.5775660	9.9996894	8.5778766	11.4221234	50
11	8.5808923	9.9996846	8.5812077	11.4187923	49
12	8.5841933	9.9996798	8.5845136	11.4154864	48
13	8.5874694	9.9996749	8.5877945	11.4122055	47
14	8.5907209	9.9996700	8.5910509	11.4089491	46
15	8.5939483	9.9996650	8.5942832	11.4057168	45
16	8.5971517	9.9996601	8.5974917	11.4025083	44
17	8.6003317	9.9996550	8.6006767	11.3993233	43
18	8.6034886	9.9996500	8.6038386	11.3961614	42
19	8.6066226	9.9996449	8.6069777	11.3930223	41
20	8.6097341	9.9996398	8.6100943	11.3899057	40
21	8.6128235	9.9996346	8.6131889	11.3868111	39
22	8.6158910	9.9996294	8.6162616	11.3837384	38
23	8.6189369	9.9996242	8.6193127	11.3806873	37
24	8.6219616	9.9996189	8.6223427	11.3776573	36
25	8.6249653	9.9996136	8.6253518	11.3746482	35
26	8.6279484	9.9996082	8.6283402	11.3716598	34
27	8.6309111	9.9996028	8.6313083	11.3686917	33
28	8.6338537	9.9995974	8.6342563	11.3657437	32
29	8.6367764	9.9995919	8.6371845	11.3628155	31
30	8.6396796	9.9995865	8.6400931	11.3599059	30
31	8.6425634	9.9995809	8.6429825	11.3570175	29
32	8.6454282	9.9995753	8.6458528	11.3541472	28
33	8.6482742	9.9995697	8.6487044	11.3512946	27
34	8.6511016	9.9995641	8.6515375	11.3484625	26
35	8.6539107	9.9995584	8.6543522	11.3456478	25
36	8.6567017	9.9995527	8.6571490	11.3428510	24
37	8.6594748	9.9995469	8.6599279	11.3400721	23
38	8.6622303	9.9995411	8.6626891	11.3373109	22
39	8.6649684	9.9995353	8.6654331	11.3345669	21
40	8.6676893	9.9995297	8.6681598	11.3318402	20
41	8.6703932	9.9995236	8.6708697	11.3291303	19
42	8.6730804	9.9995176	8.6735628	11.3264372	18
43	8.6757510	9.9995116	8.6762393	11.3237607	17
44	8.6784052	9.9995056	8.6788996	11.3211004	16
45	8.6810433	9.9994996	8.6815437	11.3184563	15
46	8.6836654	9.9994935	8.6841719	11.3158281	14
47	8.6862718	9.9994874	8.6867844	11.3132156	13
48	8.6888625	9.9994812	8.6893813	11.3106187	12
49	8.6914379	9.9994750	8.6919629	11.3080371	11
50	8.6939985	9.9994688	8.6945292	11.3054708	10
51	8.6965431	9.9994625	8.6970806	11.3029194	9
52	8.699073[illegible]	9.9994562	8.6996172	11.3003828	8
53	8.7015889	9.9994498	8.7021390	11.2978610	7
54	8.7040899	9.9994435	8.7046465	11.2953535	6
55	8.7065766	9.9994370	8.7071395	11.2928605	5
56	8.7090490	9.9994306	8.7096185	11.2903815	4
57	8.7115075	9.9994241	8.7120384	11.2879166	3
58	8.7139520	9.9994176	8.7145345	11.2854655	2
59	8.7163829	9.9994110	8.7169719	11.2830281	1
60	8.7188002	9.9994044	8.7193958	11.2806042	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

87 Degrees

3 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.7188002	9.9994044	8.7193958	11.2806042	60
1	8.7212040	9.9993978	8.7218063	11.2781937	59
2	8.7235946	9.9993911	8.7242035	11.2757965	58
3	8.7259721	9.9993844	8.7265877	11.2734123	57
4	8.7283366	9.9993776	8.7289589	11.2710411	56
5	8.7306882	9.9993708	8.7313174	11.2686826	55
6	8.7330272	9.9993640	8.7336631	11.2663369	54
7	8.7353535	9.9993572	8.7359964	11.2640036	53
8	8.7376675	9.9993503	8.7383172	11.2616828	52
9	8.7399698	9.9993433	8.7406258	11.2593742	51
10	8.7422586	9.9993364	8.7429222	11.2570778	50
11	8.7445360	9.9993293	8.7452067	11.2547933	49
12	8.7468015	9.9993223	8.7474792	11.2525208	48
13	8.7490553	9.9993152	8.7497400	11.2502600	47
14	8.7512973	9.9993081	8.7519892	11.2480108	46
15	8.7535278	9.9993009	8.7542269	11.2457731	45
16	8.7557469	9.9992938	8.7564531	11.2435469	44
17	8.7579546	9.9992865	8.7586681	11.2413319	43
18	8.7601512	9.9992793	8.7608719	11.2391281	42
19	8.7623366	9.9992720	8.7630647	11.2369353	41
20	8.7645111	9.9992646	8.7652465	11.2347535	40
21	8.7666747	9.9992572	8.7674175	11.2325825	39
22	8.7688275	9.9992498	8.7695777	11.2304223	38
23	8.7709697	9.9992424	8.7717274	11.2282726	37
24	8.7731014	9.9992349	8.7738665	11.2261335	36
25	8.7752226	9.9992274	8.7759952	11.2240048	35
26	8.7773334	9.9992198	8.7781136	11.2218864	34
27	8.7794340	9.9992122	8.7802218	11.2197782	33
28	8.7815244	9.9992046	8.7823199	11.2176801	32
29	8.7836048	9.9991969	8.7844079	11.2155921	31
30	8.7856753	9.9991892	8.7864861	11.2135139	30
31	8.7877359	9.9991815	8.7885544	11.2114456	29
32	8.7897867	9.9991737	8.7906130	11.2093870	28
33	8.7918278	9.9991659	8.7926620	11.2073380	27
34	8.793859[illegible]	9.9991580	8.7947014	11.2052986	26
35	8.7958814	9.9991501	8.7967313	11.2032687	25
36	8.7978941	9.9991422	8.7987519	11.2012481	24
37	8.7998974	9.9991342	8.8007632	11.1992368	23
38	8.8018915	9.9991262	8.8027653	11.1972347	22
39	8.8038764	9.9991182	8.8047583	11.1952417	21
40	8.8058523	9.9991101	8.8067422	11.1932578	20
41	8.8078192	9.9991020	8.8087172	11.1912828	19
42	8.8097772	9.9990938	8.8106834	11.1893166	18
43	8.8117264	9.9990856	8.8126407	11.1873593	17
44	8.8136668	9.9990774	8.8145894	11.1854106	16
45	8.8155985	9.9990691	8.8165294	11.1834706	15
46	8.8175217	9.9990608	8.8184608	11.1815392	14
47	8.8194363	9.9990525	8.8203838	11.1796162	13
48	8.8213425	9.9990441	8.8222984	11.1777016	12
49	8.8232404	9.9990357	8.8242046	11.1757954	11
50	8.8251299	9.9990273	8.8261026	11.1738974	10
51	8.8270112	9.9990188	8.8279924	11.1720076	9
52	8.8288844	9.9990103	8.8298741	11.1701259	8
53	8.8307495	9.9990017	8.8317478	11.1682522	7
54	8.8326066	9.9989931	8.8336134	11.1663866	6
55	8.8344557	9.9989845	8.8354712	11.1645288	5
56	8.8362969	9.9989758	8.8373211	11.1626789	4
57	8.8381304	9.9989671	8.8391633	11.1608367	3
58	8.8399561	9.9989584	8.8409977	11.1590023	2
59	8.8417741	9.9989496	8.8428245	11.1571755	1
60	8.8435845	9.9989408	8.8446437	11.1553563	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

86 Degrees

4 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.8435845	9.9989408	8.8446437	11.1553563	60
1	8.8453874	9.9989319	8.8464554	11.1535446	59
2	8.8471827	9.9989230	8.8482597	11.1517403	58
3	8.8489707	9.9989141	8.8500566	11.1499435	57
4	8.8507512	9.9989052	8.8518461	11.1481539	56
5	8.8525245	9.9988962	8.8536283	11.1463717	55
6	8.8542905	9.9988871	8.8554039	11.1445966	54
7	8.8560493	9.9988780	8.8571713	11.1428287	53
8	8.8578010	9.9988689	8.8589321	11.1410679	52
9	8.8595457	9.9988598	8.8606859	11.1393141	51
10	8.8612833	9.9988506	8.8624327	11.1375673	50
11	8.8630139	9.9988414	8.8641725	11.1358275	49
12	8.8647376	9.9988321	8.8659055	11.1340945	48
13	8.8664545	9.9988228	8.8676317	11.1323683	47
14	8.8681646	9.9988135	8.8693511	11.1306439	46
15	8.8698680	9.9988041	8.8710638	11.1289362	45
16	8.8715646	9.9987947	8.8727699	11.1272301	44
17	8.8732546	9.9987853	8.8744694	11.1255306	43
18	8.8749381	9.9987758	8.8761623	11.1238377	42
19	8.8766150	9.9987663	8.8778487	11.1221513	41
20	8.8782854	9.9987567	8.8795286	11.1204714	40
21	8.8799493	9.9987471	8.8812022	11.1187978	39
22	8.8816069	9.9987375	8.8828694	11.1171306	38
23	8.8832581	9.9987278	8.8845303	11.1154697	37
24	8.8849031	9.9987181	8.8861850	11.1138150	36
25	8.8865418	9.9987084	8.8878334	11.1121666	35
26	8.8881743	9.9986986	8.8894757	11.1105243	34
27	8.8898007	9.9986888	8.8911119	11.1088881	33
28	8.8914209	9.9986790	8.8927420	11.1072580	32
29	8.8930351	9.9986691	8.8943660	11.1056340	31
30	8.8946433	9.9986591	8.8959842	11.1040158	30
31	8.8962455	9.9986492	8.8975963	11.1024037	29
32	8.8978418	9.9986392	8.8992026	11.1007974	28
33	8.8994322	9.9986292	8.9008030	11.0991970	27
34	8.9010168	9.9986191	8.9023977	11.0976023	26
35	8.9025955	9.9986090	8.9039866	11.0960134	25
36	8.9041685	9.9985988	8.9055697	11.0944303	24
37	8.9057358	9.9985886	8.9071472	11.0928528	23
38	8.9072975	9.9985784	8.9087190	11.0912810	22
39	8.9088535	9.9985682	8.9102853	11.0897147	21
40	8.9104039	9.9985579	8.9118460	11.0881540	20
41	8.9119487	9.9985475	8.9134012	11.0865988	19
42	8.9134881	9.9985372	8.9149509	11.0850491	18
43	8.9150219	9.9985268	8.9164952	11.0835048	17
44	8.9165504	9.9985163	8.9180340	11.0819660	16
45	8.9180734	9.9985058	8.9195675	11.0804325	15
46	8.9195911	9.9984953	8.9210957	11.0789043	14
47	8.9211034	9.9984848	8.9226186	11.0773814	13
48	8.9226105	9.9984742	8.9241363	11.0758637	12
49	8.9241123	9.9984636	8.9256487	11.0743513	11
50	8.9256089	9.9984529	8.9271560	11.0728440	10
51	8.9271003	9.9984422	8.9286581	11.0713419	9
52	8.9285866	9.9984315	8.9301552	11.0698448	8
53	8.9300678	9.9984207	8.9316471	11.0683529	7
54	8.9315439	9.9984099	8.9331340	11.0668660	6
55	8.9330150	9.9983990	8.9346160	11.0653840	5
56	8.9344811	9.9983881	8.9360929	11.0639071	4
57	8.9359422	9.9983772	8.9375650	11.0624350	3
58	8.9373983	9.9983663	8.9390321	11.0609679	2
59	8.9388496	9.9983553	8.9404944	11.0595056	1
60	8.9402960	9.9983442	8.9419518	11.0580482	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

85 Degrees

5 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	8.9402960	9.9983442	8.9419518	11.0580482	60
1	8.9417376	9.9983332	8.9434044	11.0565956	59
2	8.9431743	9.9983220	8.9448523	11.0551477	58
3	8.9446063	9.9983109	8.9462954	11.0537046	57
4	8.9460333	9.9982997	8.9477338	11.0522662	56
5	8.9474561	9.9982885	8.9491676	11.0508324	55
6	8.9488739	9.9982772	8.9505967	11.0494033	54
7	8.9502871	9.9982660	8.9520211	11.0479789	53
8	8.9516957	9.9982546	8.9534410	11.0465590	52
9	8.9530996	9.9982433	8.9548564	11.0451436	51
10	8.9544991	9.9982318	8.9562672	11.0437328	50
11	8.9558940	9.9982204	8.9576735	11.0423265	49
12	8.9572843	9.9982089	8.9590754	11.0409246	48
13	8.9586703	9.9981974	8.9604728	11.0396272	47
14	8.9600517	9.9981859	8.9618659	11.0381341	46
15	8.9614288	9.9981743	8.9632545	11.0367455	45
16	8.9628014	9.9981629	8.9646386	11.0353614	44
17	8.9641697	9.9981510	8.9660188	11.0339812	43
18	8.9655337	9.9981393	8.9673944	11.0326056	42
19	8.9668934	9.9981275	8.9687658	11.0312342	41
20	8.9682487	9.9981158	8.9701330	11.0298670	40
21	8.9695999	9.9981040	8.9714959	11.0285041	39
22	8.9709468	9.9980921	8.9728547	11.0271453	38
23	8.9722895	9.9980802	8.9742092	11.0257908	37
24	8.9736280	9.9980683	8.9755597	11.0244403	36
25	8.9749624	9.9980563	8.9769060	11.0230940	35
26	8.9762926	9.9980443	8.9782483	11.0217517	34
27	8.9776188	9.9980323	8.9795865	11.0204135	33
28	8.9789408	9.9980202	8.9809206	11.0190794	32
29	8.9802589	9.9980081	8.9822507	11.0177493	31
30	8.9815729	9.9979960	8.9835769	11.0164231	30
31	8.9828829	9.9979838	8.9848991	11.0151009	29
32	8.9841889	9.9979716	8.9862173	11.0137827	28
33	8.9854910	9.9979593	8.9875317	11.0124683	27
34	8.9867891	9.9979470	8.9888421	11.0111579	26
35	8.9880834	9.9979347	8.9901487	11.0098513	25
36	8.9893737	9.9979223	8.9914514	11.0085486	24
37	8.9906602	9.9979099	8.9927503	11.0072497	23
38	8.9919429	9.9978975	8.9940454	11.0059546	22
39	8.9932217	9.9978850	8.9953367	11.0046633	21
40	8.9944968	9.9978725	8.9966243	11.0033757	20
41	8.9957681	9.9978599	8.9979081	11.0020919	19
42	8.9970356	9.9978473	8.9991883	11.0008117	18
43	8.9982994	9.9978347	9.0004647	10.9995353	17
44	8.9995595	9.9978220	9.0017375	10.9982625	16
45	9.0008160	9.9978093	9.0030066	10.9969934	15
46	9.0020687	9.9977966	9.0042721	10.9957279	14
47	9.0033179	9.9977838	9.0055340	10.9944660	13
48	9.0045634	9.9977710	9.0067924	10.9932076	12
49	9.0058053	9.9977582	9.0080471	10.9919529	11
50	9.0070436	9.9977453	9.0092984	10.9907016	10
51	9.0082784	9.9977323	9.0105461	10.9894539	9
52	9.0095096	9.9977194	9.0117903	10.9882097	8
53	9.0107374	9.9977064	9.0130310	10.9869690	7
54	9.0119616	9.9976933	9.0142682	10.9857318	6
55	9.0131823	9.9976803	9.0155021	10.9844979	5
56	9.0143996	9.9976672	9.0167325	10.9832675	4
57	9.0156135	9.9976540	9.0179594	10.9820406	3
58	9.0168239	9.9976408	9.0191831	10.9808169	2
59	9.0180309	9.9976276	9.0204033	10.9795967	1
60	9.0192346	9.9976143	9.0216202	10.9783798	0
	Sine Comp.	Sine	Tang. Com.	Tang	Min.

84 Degrees

6 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.0192346	9.9976143	9.0216202	10.9783798	60
1	9.0204348	9.9976011	9.0228338	10.9771662	59
2	9.0216318	9.9975877	9.0240441	10.9759559	58
3	9.0228254	9.9975743	9.0252510	10.9747490	57
4	9.0240157	9.9975609	9.0264548	10.9735452	56
5	9.0252027	9.9975475	9.0276552	10.9723448	55
6	9.0263865	9.9975340	9.0288524	10.9711476	54
7	9.0275669	9.9975205	9.0300464	10.9699536	53
8	9.0287442	9.9975069	9.0312373	10.9687627	52
9	9.0299182	9.9974933	9.0324249	10.9675751	51
10	9.0310890	9.9974797	9.0336093	10.9663907	50
11	9.0322567	9.9974660	9.0347906	10.9652094	49
12	9.0334212	9.9974523	9.0359688	10.9640312	48
13	9.0345825	9.9974386	9.0371439	10.9628561	47
14	9.0357407	9.9974248	9.0383159	10.9616841	46
15	9.0368958	9.9974110	9.0394848	10.9605152	45
16	9.0380477	9.9973971	9.0406506	10.9593494	44
17	9.0391966	9.9973833	9.0418134	10.9581866	43
18	9.0403424	9.9973693	9.0429731	10.9570269	42
19	9.0414852	9.9973554	9.0441299	10.9558701	41
20	9.0426249	9.9973414	9.0452836	10.9547164	40
21	9.0437617	9.9973273	9.0464343	10.9535657	39
22	9.0448954	9.9973132	9.0475821	10.9524179	38
23	9.0460261	9.9972991	9.0487270	10.9512730	37
24	9.0471538	9.9972850	9.0498689	10.9501311	36
25	9.0482786	9.9972708	9.0510078	10.9489922	35
26	9.0494005	9.9972566	9.0521439	10.9478561	34
27	9.0505194	9.9972423	9.0532771	10.9467229	33
28	9.0516354	9.9972280	9.0544074	10.9455926	32
29	9.0527485	9.9972137	9.0555349	10.9444651	31
30	9.0538588	9.9971993	9.0566595	10.9433405	30
31	9.0549661	9.9971849	9.0577813	10.9422187	29
32	9.0560706	9.9971704	9.0589002	10.9410998	28
33	9.0571723	9.9971559	9.0600164	10.9399836	27
34	9.0582711	9.9971414	9.0611297	10.9388703	26
35	9.0593671	9.9971268	9.0622403	10.9377597	25
36	9.0604604	9.9971122	9.0633482	10.9366518	24
37	9.0615509	9.9970976	9.0644533	10.9355467	23
38	9.0626386	9.9970829	9.0655556	10.9344444	22
39	9.0637235	9.9970682	9.0666553	10.9333447	21
40	9.0648057	9.9970535	9.0677522	10.9322478	20
41	9.0658852	9.9970387	9.0688465	10.9311535	19
42	9.0669619	9.9970239	9.0699381	10.9300619	18
43	9.0680360	9.9970090	9.0710270	10.9289730	17
44	9.0691074	9.9969941	9.0721133	10.9278867	16
45	9.0701761	9.9969792	9.0731969	10.9268031	15
46	9.0712421	9.9969642	9.0742779	10.9257221	14
47	9.0723055	9.9969492	9.0753563	10.9246437	13
48	9.0733663	9.9969342	9.0764321	10.9235679	12
49	9.0744244	9.9969191	9.0775053	10.9224947	11
50	9.0754799	9.9969040	9.0785760	10.9214240	10
51	9.0765329	9.9968888	9.0796441	10.9203559	9
52	9.0775832	9.9968736	9.0807096	10.9192904	8
53	9.0786310	9.9968584	9.0817726	10.9182274	7
54	9.0796762	9.9968431	9.0828331	10.9171669	6
55	9.0807189	9.9968278	9.0838911	10.9161089	5
56	9.0817590	9.9968125	9.0849466	10.9150534	4
57	9.0827966	9.9967971	9.0859996	10.9140004	3
58	9.0838317	9.9967817	9.0870501	10.9129499	2
59	9.0848643	9.9967662	9.0880981	10.9119019	1
60	9.0858945	9.9967507	9.0891438	10.9108562	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

83 Degrees

7 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.0858945	9.9967507	9.0891438	10.9108562	60
1	9.0869221	9.9967352	9.0901869	10.9098131	59
2	9.0879473	9.9967196	9.0912277	10.9087723	58
3	9.0889700	9.9967040	9.0922660	10.9077340	57
4	9.0899903	9.9966884	9.0933020	10.9066980	56
5	9.0910082	9.9966727	9.0943355	10.9056645	55
6	9.0920237	9.9966570	9.0953667	10.9046333	54
7	9.0930367	9.9966412	9.0963955	10.9036045	53
8	9.0940474	9.9966254	9.0974219	10.9025781	52
9	9.0950556	9.9966096	9.0984460	10.9015540	51
10	9.0960615	9.9965937	9.0994678	10.9005322	50
11	9.0970651	9.9965778	9.1004872	10.8995128	49
12	9.0980662	9.9965619	9.1015044	10.8984956	48
13	9.0990651	9.9965459	9.1025192	10.8974808	47
14	9.1000616	9.9965299	9.1035317	10.8964683	46
15	9.1010558	9.9965138	9.1045410	10.8954580	45
16	9.1020477	9.9964977	9.1055500	10.8944500	44
17	9.1030373	9.9964816	9.1065557	10.8934443	43
18	9.1040246	9.9964655	9.1075591	10.8924409	42
19	9.1050096	9.9964493	9.1085604	10.8914366	41
20	9.1059924	9.9964330	9.1095594	10.8904406	40
21	9.1069729	9.9964167	9.1105562	10.8894438	39
22	9.1079512	9.9964004	9.1115508	10.8884492	38
23	9.1089272	9.9963841	9.1125431	10.8874569	37
24	9.1099010	9.9963677	9.1135333	10.8864667	36
25	9.1108726	9.9963513	9.1145213	10.8854787	35
26	9.1118420	9.9963348	9.1155072	10.8844928	34
27	9.1128092	9.9963183	9.1164909	10.8835091	33
28	9.1137742	9.9963018	9.1174724	10.8825276	32
29	9.1147370	9.9962852	9.1184518	10.8815482	31
30	9.1156977	9.9962686	9.1194291	10.8805709	30
31	9.1166562	9.9962519	9.1204043	10.8795957	29
32	9.1176125	9.9962352	9.1213773	10.8786227	28
33	9.1185667	9.9962185	9.1223482	10.8776518	27
34	9.1195188	9.9962017	9.1233171	10.8766829	26
35	9.1204688	9.9961849	9.1242839	10.8757161	25
36	9.1214167	9.9961681	9.1252486	10.8747514	24
37	9.1223624	9.9961512	9.1262112	10.8737888	23
38	9.1233061	9.9961343	9.1271718	10.8728282	22
39	9.1242477	9.9961174	9.1281303	10.8718697	21
40	9.1251872	9.9961004	9.1290868	10.8709132	20
41	9.1261246	9.9960834	9.1300413	10.8699587	19
42	9.1270000	9.9960663	9.1309937	10.8690063	18
43	9.1279934	9.9960492	9.1319442	10.8680558	17
44	9.1289247	9.9960321	9.1328926	10.8671074	16
45	9.1298539	9.9960149	9.1338391	10.8661609	15
46	9.1307812	9.9959977	9.1347835	10.8652165	14
47	9.1317064	9.9959804	9.1357260	10.8642740	13
48	9.1326297	9.9959631	9.1366665	10.8633335	12
49	9.1335509	9.9959458	9.1376051	10.8623949	11
50	9.1344702	9.9959284	9.1385417	10.8614583	10
51	9.1353875	9.9959111	9.1394764	10.8605236	9
52	9.1363028	9.9958936	9.1404092	10.8595908	8
53	9.1372161	9.9958761	9.1413400	10.8586600	7
54	9.1381275	9.9958586	9.1422689	10.8577311	6
55	9.1390370	9.9958411	9.1431959	10.8568041	5
56	9.1399445	9.9958235	9.1441210	10.8558790	4
57	9.1408501	9.9958059	9.1450442	10.8549588	3
58	9.1417537	9.9957882	9.1459655	10.8540345	2
59	9.1426555	9.9957705	9.1468850	10.8531150	1
60	9.1435553	9.9957528	9.1478025	10.8521975	0
	Sine Comp.	Sine	Tang. Com.	Tang.	

85 Degrees

Min.	8 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.1435553	9.9957528	9.1478025	10.8521975	60
1	9.1444532	9.9957350	9.1487182	10.8512818	59
2	9.1453493	9.9957172	9.1496321	10.8503679	58
3	9.1462435	9.9956993	9.1505441	10.8494559	57
4	9.1471358	9.9956815	9.1514543	10.8485457	56
5	9.1480262	9.9956635	9.1523627	10.8476373	55
6	9.1489148	9.9956456	9.1532692	10.8467308	54
7	9.1498015	9.9956276	9.1541739	10.8458261	53
8	9.1506864	9.9956095	9.1550769	10.8449231	52
9	9.1515694	9.9955915	9.1559780	10.8440220	51
10	9.1524507	9.9955734	9.1568773	10.8431227	50
11	9.1533301	9.9955552	9.1577748	10.8422252	49
12	9.1542076	9.9955370	9.1586706	10.8413294	48
13	9.1550834	9.9955188	9.1595646	10.8404354	47
14	9.1559574	9.9955005	9.1604569	10.8395431	46
15	9.1568296	9.9954822	9.1613473	10.8386527	45
16	9.1577000	9.9954639	9.1622361	10.8377639	44
17	9.1585686	9.9954455	9.1631231	10.8368769	43
18	9.1594354	9.9954271	9.1640083	10.8359917	42
19	9.1603005	9.9954087	9.1648919	10.8351081	41
20	9.1611639	9.9953902	9.1657737	10.8342263	40
21	9.1620254	9.9953717	9.1666538	10.8333462	39
22	9.1628853	9.9953531	9.1675322	10.8324678	38
23	9.1637434	9.9953345	9.1684989	10.8315911	37
24	9.1645998	9.9953159	9.1692839	10.8307161	36
25	9.1654544	9.9952972	9.1701572	10.8298428	35
26	9.1663074	9.9952785	9.1710289	10.8289711	34
27	9.1671586	9.9952597	9.1718989	10.8281011	33
28	9.1680081	9.9952409	9.1727672	10.8272328	32
29	9.1688559	9.9952221	9.1736338	10.8263662	31
30	9.1697021	9.9952033	9.1744988	10.8255012	30
31	9.1705465	9.9951844	9.1753622	10.8246378	29
32	9.1713893	9.9951654	9.1762239	10.8237761	28
33	9.1722305	9.9951464	9.1770840	10.8229260	27
34	9.1730699	9.9951274	9.1779425	10.8220575	26
35	9.1739077	9.9951084	9.1787993	10.8212007	25
36	9.1747439	9.9950893	9.1796546	10.8203454	24
37	9.1755784	9.9950702	9.1805082	10.8194918	23
38	9.1764112	9.9950510	9.1813602	10.8186398	22
39	9.1772425	9.9950318	9.1822106	10.8177894	21
40	9.1780721	9.9950126	9.1830595	10.8169405	20
41	9.1789001	9.9949933	9.1839068	10.8160932	19
42	9.1797265	9.9949740	9.1847525	10.8152475	18
43	9.1805512	9.9949546	9.1855966	10.8144034	17
44	9.1813744	9.9949352	9.1864392	10.8135608	16
45	9.1821960	9.9949158	9.1872802	10.8127198	15
46	9.1830160	9.9948964	9.1881196	10.8118804	14
47	9.1838344	9.9948769	9.1889575	10.8110425	13
48	9.1846512	9.9948573	9.1897939	10.8102061	12
49	9.1854665	9.9948377	9.1906287	10.8093713	11
50	9.1862802	9.9948181	9.1914621	10.8085379	10
51	9.1870923	9.9947985	9.1922939	10.8077061	9
52	9.1879029	9.9947788	9.1931241	10.8068759	8
53	9.1887120	9.9947591	9.1939529	10.8060471	7
54	9.1895195	9.9947393	9.1947802	10.8052198	6
55	9.1903254	9.9947195	9.1956059	10.8043941	5
56	9.1911299	9.9946997	9.1964302	10.8035698	4
57	9.1919328	9.9946798	9.1972530	10.8027470	3
58	9.1927342	9.9946599	9.1980743	10.8019257	2
59	9.1935341	9.9946399	9.1988941	10.8011059	1
60	9.1943324	9.9946199	9.1997125	10.8002875	0
	Sine Comp.	Sine	Tang. Com·	Tang.	Min.
	81 Degrees				

Min.	9 Degrees				
	Sine	Sine Comp,	Tang.	Tang. Comp·	
0	9.1943324	9.9946199	9.1997125	10.8002875	60
1	9.1951293	9.9945999	9.2005294	10.7994706	59
2	9.1959247	9 9945798	9.2013449	10.7986551	58
3	9.1967186	9.9945597	9.2021588	10.7978412	57
4	9.1975110	9.9945396	9.2029714	10.7970286	56
5	9.1983019	9.9945194	9.2037825	10.7962175	55
6	9.1999913	9.9944992	9.2045922	10.7954078	54
7	9.1998793	9.9944789	9.2054004	10.7945996	53
8	9.2006658	9.9944587	9.2062072	10.7937928	52
9	9.2014509	9.9944383	9.2070126	10.7929874	51
10	9.2022345	9.9944180	9.2078165	10.7921835	50
11	9.2030167	9.9943975	9.2086191	10.7913809	49
12	9.2037974	9.9943771	9.2094203	10.7905797	48
13	9.2045766	9.9943566	9.2102200	10.7897800	47
14	9.2053545	9.9943361	9.2110184	10.7889816	46
15	9.2061309	9.9943156	9.2118153	10.7881847	45
16	9.2069059	9.9942950	9.2126109	10.7873891	44
17	9.2076795	9.9942743	9.2134051	10.7865949	43
18	9.2084516	9.9942537	9.2141980	10.7858020	42
19	9.2092224	9.9942330	9.2149894	10.7850106	41
20	9.2099917	9.9942122	9.2157795	10.7842205	40
21	9 2107597	9.9941914	9.2165683	10.7834317	39
22	9.2115263	9.9941706	9.2173556	10.7826444	38
23	9.2122914	9.9941498	9.2181417	10.7818583	37
24	9.2130552	9.9941289	9.2189264	10.7810736	36
25	9.2138176	9.9941079	9.2197097	10.7802903	35
26	9.2145787	9.9940870	9.2204917	10.7795083	34
27	9.2153384	9.9940659	9.2212724	10.7787276	33
28	9.2160967	9.9940449	9.2220518	10.7779482	32
29	9.2168536	9.9940238	9.2228298	10.7771702	31
30	9.2176092	9.9940027	9.2236065	10.7763935	30
31	9.2183635	9.9939815	9.2243819	10.7750181	29
32	9.2191164	9.9939603	9.2251561	10.7748439	28
33	9.2198680	9.9939391	9.2259289	10.7740711	27
34	9.2206182	9.9939178	9.2267004	10.7732996	26
35	9.2213671	9.9938965	9.2274706	10.7725294	25
36	9.2221147	9.9938752	9.2282395	10.7717605	24
37	9.2228609	9.9938538	9.2290071	10.7709919	23
38	9.2236059	9.9938324	9.2297735	10.7702265	22
39	9.2243495	9.9938109	9.2305386	10.7694614	21
40	9.2250918	9.9937894	9.2313024	10.7686976	20
41	9.2258328	9.9937679	9.2320650	10.7679350	19
42	9.2265725	9.9937463	9.2328262	10.7671738	18
43	9.2273110	9.9937247	9.2335863	10.7664137	17
44	9.2280481	9.9937030	9.2343451	10.7656549	16
45	9.2287839	9.9936813	9.2351026	10.7648974	15
46	9.2295185	9.9936596	9.2358589	10.7641411	14
47	9.2302518	9.9936378	9.2366139	10.7633861	13
48	9.2309838	9.9936160	9.2373678	10.7626322	12
49	9.2317145	9.9935942	9.2381203	10.7618797	11
50	9.2324440	9.9935723	9.2388717	10.7611283	10
51	9.2331722	9.9935504	9.2396218	10.7603782	9
52	9.2338992	9.9935285	9.2403708	10.7596292	8
53	9.2346249	9.9935065	9.2411185	10.7588815	7
54	9.2353494	9.9934844	9.2418650	10.7581350	6
55	9.2360726	9.9934624	9.2426103	10.7573897	5
56	9.2367946	9.9934403	9.2433543	10.7566457	4
57	9.2375153	9.9934181	9.2440972	10.7559028	3
58	9.2382349	9.9933959	9.2448389	10.7551611	2
59	9.2389532	9.9933737	9.2455794	10.7544206	1
60	9.2396702	9.9933515	9.2463188	10.7536812	0
	Sine Comp.	Sine	Taug. Com	Tang.	Min.
	80 Degrees				

10 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.2396702	9.9933515	9.2463188	10.7536812	60
1	9.2403861	9.9933292	9.2470569	10.7539431	59
2	9.2411007	9.9933068	9.2477939	10.7522061	58
3	9.2418141	9.9932845	9.2485297	10.7514703	57
4	9.2425264	9.9932621	9.2492643	10.7507357	56
5	9.2432374	9.9932396	9.2499978	10.7500022	55
6	9.2439472	9.9932171	9.2507301	10.7492699	54
7	9.2446558	9.9931946	9.2514612	10.7485388	53
8	9.2453632	9.9931720	9.2521912	10.7478088	52
9	9.2460695	9.9931494	9.2529200	10.7470800	51
10	9.2467746	9.9931268	9.2536477	10.7463523	50
11	9.2474784	9.9931041	9.2543743	10.7456257	49
12	9.2481811	9.9930814	9.2550997	10.7449003	48
13	9.2488827	9.9930587	9.2558240	10.7441760	47
14	9.2495830	9.9930359	9.2565472	10.7434528	46
15	9.2502822	9.9930131	9.2572692	10.7427308	45
16	9.2509803	9.9929902	9.2579901	10.7420099	44
17	9.2516772	9.9929673	9.2587099	10.7412901	43
18	9.2523729	9.9929444	9.2594285	10.7405715	42
19	9.2530675	9.9929214	9.2601461	10.7398539	41
20	9.2537609	9.9928984	9.2608625	10.7391375	40
21	9.2544532	9.9928753	9.2615779	10.7384221	39
22	9.2551444	9.9928522	9.2622921	10.7377079	38
23	9.2558344	9.9928291	9.2630053	10.7369947	37
24	9.2565233	9.9928059	9.2637173	10.7362827	36
25	9.2572110	9.9927827	9.2644283	10.7355717	35
26	9.2578977	9.9927595	9.2651382	10.7348618	34
27	9.2585832	9.9927362	9.2658470	10.7341530	33
28	9.2592676	9.9927129	9.2665547	10.7334453	32
29	9.2599509	9.9926895	9.2672613	10.7327387	31
30	9.2606330	9.9926661	9.2679669	10.7320331	30
31	9.2613141	9.9926427	9.2686714	10.7313286	29
32	9.2619941	9.9926192	9.2693749	10.7306251	28
33	9.2626729	9.9925957	9.2700772	10.7299228	27
34	9.2633507	9.9925722	9.2707786	10.7292214	26
35	9.2640274	9.9925486	9.2714788	10.7285212	25
36	9.2647030	9.9925250	9.2721780	10.7278220	24
37	9.2653775	9.9925013	9.2728762	10.7271238	23
38	9.2660509	9.9924776	9.2735733	10.7264267	22
39	9.2667232	9.9924539	9.2742694	10.7257306	21
40	9.2673945	9.9924301	9.2749644	10.7250356	20
41	9.2680647	9.9924063	9.2756584	10.7243416	19
42	9.2687338	9.9923824	9.2763514	10.7236486	18
43	9.2694019	9.9923585	9.2770434	10.7229566	17
44	9.2700689	9.9923346	9.2777343	10.7226257	16
45	9.2707348	9.9923106	9.2784242	10.7215758	15
46	9.2713997	9.9922866	9.2791131	10.7208869	14
47	9.2720635	9.9922626	9.2798009	10.7201991	13
48	9.2727263	9.9922385	9.2804878	10.7195122	12
49	9.2733880	9.9922144	9.2811736	10.7188264	11
50	9.2740487	9.9921902	9.2818585	10.7181415	10
51	9.2747083	9.9921660	9.2825423	10.7174577	9
52	9.2753669	9.9921418	9.2832251	10.7167749	8
53	9.2760245	9.9921175	9.2839070	10.7160930	7
54	9.2766811	9.9920932	9.2845878	10.7154122	6
55	9.2773366	9.9920689	9.2852677	10.7147323	5
56	9.2779911	9.9920455	9.2859466	10.7140534	4
57	9.2786445	9.9920201	9.2866245	10.7133755	3
58	9.2792970	9.9919956	9.2873014	10.7126986	2
59	9.2799484	9.9919711	9.2879773	10.7120227	1
60	9.2805988	9.9919466	9.2886523	10.7113477	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

79 Degrees

11 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.2805988	9.9919466	9.2886523	10.7113477	60
1	9.2812483	9.9919220	9.2893263	10.7106737	59
2	9.2818967	9.9918974	9.2899993	10.7100007	58
3	9.2825441	9.9918727	9.2906713	10.7093287	57
4	9.2831905	9.9918480	9.2913424	10.7086576	56
5	9.2838359	9.9918233	9.2920126	10.7079874	55
6	9.2844803	9.9917986	9.2926817	10.7073183	54
7	9.2851237	9.9917737	9.2933500	10.7066500	53
8	9.2857661	9.9917489	9.2940172	10.7059828	52
9	9.2864076	9.9917240	9.2946836	10.7053164	51
10	9.2870480	9.9916991	9.2953489	10.7046511	50
11	9.2876875	9.9916741	9.2960134	10.7039866	49
12	9.2883260	9.9916492	9.2966769	10.7033231	48
13	9.2889636	9.9916241	9.2973395	10.7026605	47
14	9.2896001	9.9915990	9.2980011	10.7019989	46
15	9.2902357	9.9915739	9.2986618	10.7013382	45
16	9.2908704	9.9915488	9.2993216	10.7006784	44
17	9.2915040	9.9915236	9.2999804	10.7000196	43
18	9.2921367	9.9914984	9.3006383	10.6993617	42
19	9.2927685	9.9914731	9.3012954	10.6987046	41
20	9.2933993	9.9914478	9.3019514	10.6980486	40
21	9.2940291	9.9914225	9.3026066	10.6973934	39
22	9.2946580	9.9913917	9.3032609	10.6967391	38
23	9.2952859	9.9913717	9.3039143	10.6960857	37
24	9.2959129	9.9913462	9.3045667	10.6954333	36
25	9.2965390	9.9913207	9.3052183	10.6947817	35
26	9.2971641	9.9912952	9.3058689	10.6941311	34
27	9.2977883	9.9912696	9.3065187	10.6934813	33
28	9.2984116	9.9912440	9.3071675	10.6928325	32
29	9.2990339	9.9912184	9.3078155	10.6921845	31
30	9.2996553	9.9911927	9.3084626	10.6915374	30
31	9.3002758	9.9911670	9.3091088	10.6908912	29
32	9.3008953	9.9911412	9.3097541	10.6902459	28
33	9.3015140	9.9911154	9.3103985	10.6896015	27
34	9.3021317	9.9910896	9.3110421	10 6889579	26
35	9.3027485	9.9910637	9.3116848	10.6883152	25
36	9.3033644	9.9910378	9.3123266	10.6876734	24
37	9.3039794	9.9910119	9.3129675	10.6870325	23
38	9.3045934	9.9909859	9.3136076	10.6863924	22
39	9.3052066	9.9909598	9.3142468	10.6857532	21
40	9.3058189	9.9909338	9.3148851	10.6851149	20
41	9.3064303	9.9909077	9.3155226	10.6844774	19
42	9.3070407	9.9908815	9.3161592	10.6838408	18
43	9.3076503	9.9908553	9.3167950	10.6832050	17
44	9.3082590	9.9908291	9.3174299	10.6825701	16
45	9.3088668	9.9908029	9.3180640	10.6819362	15
46	9.3094737	9.9907766	9.3186972	10.6813028	14
47	9.3100798	9.9907502	9.3193295	10.6806705	13
48	9.3106849	9.9907239	9.3199611	10.6800389	12
49	9.3112892	9.9906974	9.3205918	10.6794082	11
50	9.3118926	9.9906710	9.3212216	10.6787784	10
51	9.3124951	9.9906445	9.3218506	10.6781494	9
52	9.3130968	9.9906180	9.3224788	10.6775212	8
53	9.3136976	9.9905914	9.3231061	10.6768939	7
54	9.3142975	9.9905648	9.3237327	10.6762673	6
55	9.3148965	9.9905382	9.3243584	10.6759416	5
56	9.3154947	9.9905115	9.3249832	10.6750168	4
57	9.3160921	9.9904848	9.3256073	10.6734927	3
58	9.3166885	9.9904580	9.3262305	10.6737695	2
59	9.3172842	9.9904312	9.3268529	10.6731471	1
60	9.3178789	9.9904044	9.3274745	10.6725255	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

78 Degrees

Min.	12 Degrees				
	Sine	Sine Comp.	Tang.	Tang Comp.	
0	9.3178789	9.9904044	9.3274745	10.6725255	60
1	9.3184728	9.9903775	9.3280953	10.6719047	59
2	9.3190659	9.9903506	9.3287153	10.6712847	58
3	9.3196581	9.9903237	9.3293345	10.6706655	57
4	9.3202495	9.9902967	9.3299528	10.6700472	56
5	9.3208400	9.9902697	9.3305704	10.6694996	55
6	9.3214297	9.9902426	9.3311872	10.6688128	54
7	9.3220186	9.9902155	9.3318031	10.6681969	53
8	9.3226066	9.9901883	9.3324183	10.6675817	52
9	9.3231938	9.9901612	9.3330327	10.6669673	51
10	9.3237802	9.9901339	9.3336463	10.6663537	50
11	9.3243657	9.9901067	9.3342591	10.6657409	49
12	9.3249505	9.9900794	9.3348711	10.6651289	48
13	9.3255344	9.9900521	9.3354823	10.6645177	47
14	9.3261174	9.9900247	9.3360927	10.6639073	46
15	9.3266997	9.9899973	9.3367024	10.6632976	45
16	9.3272811	9.9899698	9.3373113	10.6626887	44
17	9.3278617	9.9899423	9.3379194	10.6620806	43
18	9.3284416	9.9899148	9.3385267	10.6614733	42
19	9.3290206	9.9898873	9.3391333	10.6608667	41
20	9.3295988	9.9898597	9.3397391	10.6602609	40
21	9.3301761	9.9898320	9.3403441	10.6596559	39
22	9.3307527	9.9898043	9.3409484	10.6590516	38
23	9.3313285	9.9897766	9.3415519	10.6584481	37
24	9.3319035	9.9897489	9.3421546	10.6578454	36
25	9.3324777	9.9897211	9.3427566	10.6572434	35
26	9.3330511	9.9896932	9.3433578	10.6566422	34
27	9.3336237	9.9896654	9.3439583	10.6560417	33
28	9.3341955	9.9896374	9.3445580	10.6554420	32
29	9.3347665	9.9896095	9.3451570	10.6548430	31
30	9.3353368	9.9895815	9.3457552	10.6542448	30
31	9.3359062	9.9895535	9.3463527	10.6536473	29
32	9.3364749	9.9895254	9.3469494	10.6530506	28
33	9.3370428	9.9894973	9.3475454	10.6524546	27
34	9.3376099	9.9894692	9.3481407	10.6518593	26
35	9.3381762	9.9894410	9.3487352	10.6512648	25
36	9.3387418	9.9894128	9.3493290	10.6506710	24
37	9.3393065	9.9893845	9.3499220	10.6500780	23
38	9.3398706	9.9893562	9.3505143	10.6494857	22
39	9.3404338	9.9893279	9.3511059	10.6488941	21
40	9.3409963	9.9892995	9.3516968	10.6483032	20
41	9.3415580	9.9892711	9.3522869	10.6477131	19
42	9.3421190	9.9892427	9.3528763	10.6471237	18
43	9.3426792	9.9892142	9.3534650	10.6465350	17
44	9.3432386	9.9891856	9.3540530	10.6459470	16
45	9.3437973	9.9891571	9.3546402	10.6453598	15
46	9.3443552	9.9891285	9.3552267	10.6447733	14
47	9.3449124	9.9890998	9.3558126	10.6441874	13
48	9.3454688	9.9890711	9.3563977	10.6436023	12
49	9.3460245	9.9890424	9.3569821	10.6430179	11
50	9.3465794	9.9890137	9.3575658	10.6424342	10
51	9.3471336	9.9889849	9.3581487	10.6418513	9
52	9.3476870	9.9889560	9.3587310	10.6412690	8
53	9.3482397	9.9889271	9.3593126	10.6406874	7
54	9.3487917	9.9888982	9.3598935	10.6401065	6
55	9.3493429	9.9888693	9.3604736	10.6395264	5
56	9.3498934	9.9888403	9.3610531	10.6389469	4
57	9.3504432	9.9888113	9.3616319	10.6383681	3
58	9.3509922	9.9887822	9.3622100	10.6377900	2
59	9.3515405	9.9887531	9.3627874	10.6372126	1
60	9.3520880	9.9887239	9.3633641	10.6366359	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	77 Degrees				

Min.	13 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.3520880	9.9887239	9.3633641	10.6366359	60
1	9.3526349	9.9886947	9.3639401	10.6360599	59
2	9.3531810	9.9886655	9.3645155	10.6354845	58
3	9.3537264	9.9886363	9.3650901	10.6349099	57
4	9.3542710	9.9886070	9.3656641	10.6343359	56
5	9.3548150	9.9885776	9.3662374	10.6337626	55
6	9.3553582	9.9885482	9.3668100	10.6331900	54
7	9.3559007	9.9885188	9.3673819	10.6326181	53
8	9.3564426	9.9884894	9.3679532	10.6320468	52
9	9.3569836	9.9884599	9.3685238	10.6314762	51
10	9.3575240	9.9884303	9.3690937	10.6309063	50
11	9.3580637	9.9884008	9.3696629	10.6303371	49
12	9.3586027	9.9883712	9.3702315	10.6297685	48
13	9.3591409	9.9883415	9.3707994	10.6292006	47
14	9.3596785	9.9883118	9.3713667	10.6286333	46
15	9.3602154	9.9882821	9.3719333	10.6280667	45
16	9.3607515	9.9882523	9.3724992	10.6275008	44
17	9.3612870	9.9882225	9.3730645	10.6269355	43
18	9.3618217	9.9881927	9.3736291	10.6263709	42
19	9.3623558	9.9881628	9.3741930	10.6258070	41
20	9.3628892	9.9881329	9.3747563	10.6252437	40
21	9.3634219	9.9881029	9.3753190	10.6246810	39
22	9.3639539	9.9880729	9.3758810	10.6241190	38
23	9.3644852	9.9880429	9.3764423	10.6235577	37
24	9.3650158	9.9880128	9.3770030	10.6229970	36
25	9.3655458	9.9874827	9.3775631	10.6224369	35
26	9.3660750	9.9879525	9.3781225	10.6218775	34
27	9.3666036	9.9879223	9.3786813	10.6213187	33
28	9.3671315	9.9878921	9.3792394	10.6207606	32
29	9.3676587	9.9878618	9.3797969	10.6202031	31
30	9.3681853	9.9878315	9.3803537	10.6196463	30
31	9.3687111	9.9878012	9.3809100	10.6190900	29
32	9.3692363	9.9877708	9.3814655	10.6185345	28
33	9.3697608	9.9877404	9.3820205	10.6179795	27
34	9.3702847	9.9877099	9.3825748	10.6174252	26
35	9.3708079	9.9876794	9.3831285	10.6168715	25
36	9.3713304	9.9876488	9.3836816	10.6163184	24
37	9.3718523	9.9876183	9.3842340	10.6157660	23
38	9.3723735	9.9875876	9.3847858	10.6152142	22
39	9.3728940	9.9875570	9.3853370	10.6146630	21
40	9.3734139	9.9875263	9.3858876	10.6141124	20
41	9.3739331	9.9874955	9.3864376	10.6135624	19
42	9.3744517	9.9874648	9.3869869	10.6130131	18
43	9.3749696	9.9874339	9.3875356	10.6124664	17
44	9.3754868	9.9874631	9.3880837	10.6119163	16
45	9.3760034	9.9873722	9.3886312	10.6115688	15
46	9.3765194	9.9873413	9.3891781	10.6108219	14
47	9.3770347	9.9873103	9.3897244	10.6102756	13
48	9.3775493	9.9872793	9.3902700	10.6097300	12
49	9.3780633	9.9872482	9.3908151	10.6091849	11
50	9.3785767	9.9872171	9.3913598	10.6086405	10
51	9.3790894	9.9871860	9.3919034	10.6080966	9
52	9.3796015	9.9871549	9.3924466	10.6075534	8
53	9.3801129	9.9871236	9.3929893	10.6070107	7
54	9.3806237	9.9870924	9.3935313	10.6064687	6
55	9.3811339	9.9870611	9.3940727	10.6059273	5
56	9.3816434	9.9870298	9.3946136	10.6053864	4
57	9.3821523	9.9869984	9.3951538	10.6048462	3
58	9.3826605	9.9869670	9.3956935	10.6043065	2
59	9.3831682	9.9869356	9.3962326	10.6037674	1
60	9.3836752	9.9869041	9.3967711	10.6032289	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	76 Degrees				

Min.	14 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.3836752	9.9869041	9.3967711	10.6032289	60
1	9.3841815	9.9868726	9.3973089	10.6026911	59
2	9.3846873	9.9868410	9.3978463	10.6021537	58
3	9.3851924	9.9868094	9.3983830	10.6016170	57
4	9.3856969	9.9867778	9.3989191	10.6010809	56
5	9.3862008	9.9867461	9.3994547	10.6005453	55
6	9.3867040	9.9867144	9.3999896	10.6000104	54
7	9.3872067	9.9866827	9.4005240	10.5994760	53
8	9.3877087	9.9866509	9.4010578	10.5989422	52
9	9.3882101	9.9866191	9.4015910	10.5984090	51
10	9.3887109	9.9865872	9.4021237	10.5978763	50
11	9.3892111	9.9865553	9.4026558	10.5973442	49
12	9.3897106	9.9865233	9.4031873	10.5968127	48
13	9.3902096	9.9864913	9.4037182	10.5962818	47
14	9.3907079	9.9864593	9.4042486	10.5957514	46
15	9.3912057	9.9864273	9.4047784	10.5952216	45
16	9.3917028	9.9863952	9.4053076	10.5946924	44
17	9.3921993	9.9863630	9.4058363	10.5941637	43
18	9.3926952	9.9863308	9.4063644	10.5936356	42
19	9.3931905	9.9862986	9.4068919	10.5931081	41
20	9.3936852	9.9862663	9.4074189	10.5925811	40
21	9.3941794	9.9862340	9.4079453	10.5920547	39
22	9.3946729	9.9862017	9.4084712	10.5915288	38
23	9.3951658	9.9861693	9.4089965	10.5910035	37
24	9.3956581	9.9861369	9.4095212	10.5904788	36
25	9.3961499	9.9861045	9.4100454	10.5899546	35
26	9.3966410	9.9860720	9.4105690	10.5894310	34
27	9.3971315	9.9860394	9.4110921	10.5889079	33
28	9.3976215	9.9860069	9.4116146	10.5883854	32
29	9.3981109	9.9859742	9.4121366	10.5878634	31
30	9.3985996	9.9859416	9.4126581	10.5873419	30
31	9.3990878	9.9859089	9.4131789	10.5868211	29
32	9.3995754	9.9858762	9.4136993	10.5863007	28
33	9.4000625	9.9858434	9.4142191	10.5857809	27
34	9.4005489	9.9858106	9.4147383	10.5852617	26
35	9.4010348	9.9857777	9.4152570	10.5847430	25
36	9.4015201	9.9857449	9.4157752	10.5842248	24
37	9.4020048	9.9857119	9.4162928	10.5837072	23
38	9.4024889	9.9856790	9.4168099	10.5831901	22
39	9.4029734	9.9856460	9.4173265	10.5826735	21
40	9.4034554	9.9856129	9.4178425	10.5821575	20
41	9.4039378	9.9855798	9.4183580	10.5816420	19
42	9.4044196	9.9855467	9.4188729	10.5811271	18
43	9.4049009	9.9855135	9.4193874	10.5806126	17
44	9.4053816	9.9854803	9.4199013	10.5800987	16
45	9.4058617	9.9854471	9.4204146	10.5795854	15
46	9.4003413	9.9854138	9.4209275	10.5790725	14
47	9.4068203	9.9853805	9.4214398	10.5785602	13
48	9.4072987	9.9853471	9.4219515	10.5780485	12
49	9.4077766	9.9853138	9.4224628	10.5775372	11
50	9.4082539	9.9852803	9.4229735	10.5770265	10
51	9.4087306	9.9852468	9.4234838	10.5765162	9
52	9.4092068	9.9852133	9.4239935	10.5760065	8
53	9.4096824	9.9851798	9.4245026	10.5754974	7
54	9.4101575	9.9851462	9.4250113	10.5749887	6
55	9.4106320	9.9851125	9.4255194	10.5744806	5
56	9.4111059	9.9850789	9.4260271	10.5739729	4
57	9.4115793	9.9850452	9.4265342	10.5734658	3
58	9.4120522	9.9850114	9.4270408	10.5729592	2
59	9.4125245	9.9849776	9.4275469	10.5724531	1
60	9.4129962	9.9849438	9.4280525	10.5719475	0
	Sine Comp.	Sine	Tang. Com	Tang.	Min.
	75 Degrees				

Min.	15 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4129962	9.9849438	9.4280525	10.5719475	60
1	9.4134674	9.9849099	9.4285575	10.5714425	59
2	9.4139381	9.9848760	9.4290621	10.5709379	58
3	9.4144082	9.9848420	9.4295661	10.5704339	57
4	9.4148778	9.9848081	9.4300697	10.5699303	56
5	9.4153468	9.9847740	9.4305727	10.5694273	55
6	9.4158152	9.9847400	9.4310753	10.5689247	54
7	9.4162832	9.9847059	9.4315773	10.5684127	53
8	9.4165506	9.9846717	9.4320789	10.5679211	52
9	9.4172174	9.9846375	9.4325799	10.5674201	51
10	9.4176837	9.9846033	9.4330804	10.5669196	50
11	9.4181495	9.9845690	9.4335805	10.5664195	49
12	9.4186148	9.9845347	9.4340800	10.5659200	48
13	9.4190795	9.9845004	9.4345791	10.5654209	47
14	9.4195436	9.9844660	9.4350776	10.5649224	46
15	9.4200073	9.9844316	9.4355757	10.5644243	45
16	9.4204704	9.9843971	9.4360733	10.5639267	44
17	9.4209330	9.9843626	9.4365704	10.5634296	43
18	9.4213950	9.9843281	9.4370670	10.5629330	42
19	9.4218566	9.9842935	9.4375631	10.5624369	41
20	9.4223176	9.9842589	9.4380587	10.5619413	40
21	9.4227780	9.9842242	9.4385538	10.5614462	39
22	9.4232380	9.9841895	9.4390485	10.5609515	38
23	9.4236974	9.9841548	9.4395426	10.5604574	37
24	9.4241563	9.9841200	9.4400363	10.5599637	36
25	9.4246147	9.9840852	9.4405295	10.5594705	35
26	9.4250726	9.9840503	9.4410222	10.5589778	34
27	9.4255299	9.9840154	9.4415145	10.5584855	33
28	9.4259867	9.9839805	9.4420062	10.5579938	32
29	9.4264430	9.9839455	9.4424975	10.5575025	31
30	9.4268988	9.9839105	9.4429883	10.5570117	30
31	9.4273541	9.9838755	9.4434786	10.5565214	29
32	9.4278089	9.9838404	9.4439685	10.5560315	28
33	9.4282631	9.9838052	9.4444579	10.5555421	27
34	9.4287169	9.9837701	9.4449468	10.5550532	26
35	9.4291701	9.9837348	9.4454352	10.5545648	25
36	9.4296228	9.9836996	9.4459232	10.5540768	24
37	9.4300750	9.9836643	9.4464107	10.5535893	23
38	9.4305267	9.9836290	9.4468978	10.5531022	22
39	9.4309779	9.9835936	9.4473843	10.5526157	21
40	9.4314286	9.9835582	9.4478704	10.5521296	20
41	9.4318788	9.9835227	9.4483561	10.5516439	19
42	9.4323285	9.9834872	9.4488413	10.5511587	18
43	9.4327777	9.9834517	9.4493260	10.5506740	17
44	9.4332264	9.9834161	9.4498102	10.5501898	16
45	9.4336746	9.9833805	9.4502940	10.5497060	15
46	9.4341223	9.9833449	9.4507774	10.5492220	14
47	9.4345694	9.9833094	9.4512602	10.5487398	13
48	9.4350161	9.9833735	9.4517427	10.5482573	12
49	9.4354623	9.9832377	9.4522246	10.5477754	11
50	9.4359080	9.9832019	9.4527061	10.5472939	10
51	9.4363532	9.9831661	9.4531872	10.5468128	9
52	9.4367980	9.9831302	9.4536678	10.5463522	8
53	9.4372422	9.9830942	9.4541479	10.5458521	7
54	9.4376859	9.9830583	9.4546276	10.5453724	6
55	9.4381292	9.9830223	9.4551069	10.5448931	5
56	9.4385719	9.9829862	9.4555857	10.5444143	4
57	9.4390142	9.9829501	9.4560641	10.5439359	3
58	9.4394560	9.9829140	9.4565420	10.5434580	2
59	9.4398973	9.9828778	9.4570194	10.5429806	1
60	9.4403381	9.9828416	9.4574964	10.5425036	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	74 Degrees				

Min.	16 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4403381	9.9828416	9.4574964	10.5425036	60
1	9.4407784	9.9828054	9.4579370	10.5420270	59
2	9.4412182	9.9827691	9.4584491	10.5415509	58
3	9.4416576	9.9827328	9.4589248	10.5410752	57
4	9.4420965	9.9826964	9.4594001	10.5405999	56
5	9.4425349	9.9826600	9.4598749	10.5401251	55
6	9.4429728	9.9826236	9.4603492	10.5396508	54
7	9.4434103	9.9825871	9.4608232	10.5391768	53
8	9.4438472	9.9825506	9.4612967	10.5387033	52
9	9.4442837	9.9825140	9.4617697	10.5382303	51
10	9.4447197	9.9824774	9.4622423	10.5377577	50
11	9.4451553	9.9824408	9.4627145	10.5372855	49
12	9.4455904	9.9824041	9.4631863	10.5368137	48
13	9.4460250	9.9823674	9.4636576	10.5363424	47
14	9.4464591	9.9823306	9.4641285	10.5358715	46
15	9.4468927	9.9822938	9.4645990	10.5354010	45
16	9.4473259	9.9822569	9.4650690	10.5349310	44
17	9.4477586	9.9822201	9.4655386	10.5344614	43
18	9.4481909	9.9821831	9.4660078	10.5339922	42
19	9.4486227	9.9821462	9.4664765	10.5335235	41
20	9.4490540	9.9821092	9.4669448	10.5330552	40
21	9.4494849	9.9820721	9.4674127	10.5325873	39
22	9.4499153	9.9820351	9.4678802	10.5321198	38
23	9.4503452	9.9819979	9.4683473	10.5316527	37
24	9.4507747	9.9819608	9.4688139	10.5311861	36
25	9.4512037	9.9819236	9.4692801	10.5307199	35
26	9.4516322	9.9818863	9.4697459	10.5302541	34
27	9.4520603	9.9818490	9.4702112	10.5297888	33
28	9.4524879	9.9818117	9.4706762	10.5293238	32
29	9.4529151	9.9817744	9.4711407	10.5288593	31
30	9.4533418	9.9817370	9.4716048	10.5283951	30
31	9.4537681	9.9816995	9.4720685	10.5279315	29
32	9.4541939	9.9816620	9.4725318	10.5274682	28
33	9.4546192	9.9816245	9.4729947	10.5270053	27
34	9.4550441	9.9815870	9.4734571	10.5265429	26
35	9.4554686	9.9815494	9.4739192	10.5260808	25
36	9.4558926	9.9815117	9.4743808	10.5256192	24
37	9.4563161	9.9814740	9.4748421	10.5251579	23
38	9.4567392	9.9814363	9.4753029	10.5246971	22
39	9.4571618	9.9813986	9.4757633	10.5242367	21
40	9.4575840	9.9813608	9.4762233	10.5237767	20
41	9.4580058	9.9813229	9.4766829	10.5233171	19
42	9.4584271	9.9812850	9.4771421	10.5228579	18
43	9.4588480	9.9812471	9.4776009	10.5223991	17
44	9.4592684	9.9812091	9.4780592	10.5219408	16
45	9.4596884	9.9811711	9.4785172	10.5214828	15
46	9.4601079	9.9811331	9.4789748	10.5210252	14
47	9.4605270	9.9810950	9.4794319	10.5205681	13
48	9.4609456	9.9810569	9.4798887	10.5201113	12
49	9.4613638	9.9810187	9.4803451	10.5196549	11
50	9.4617816	9.9809805	9.4808011	10.5191989	10
51	9.4621989	9.9809423	9.4812566	10.5187434	9
52	9.4626158	9.9809040	9.4817118	10.5182882	8
53	9.4630323	9.9808657	9.4821666	10.5178334	7
54	9.4634483	9.9808273	9.4826210	10.5173790	6
55	9.4638639	9.9807889	9.4830750	10.5169250	5
56	9.4642790	9.9 07505	9.4835286	10.5164714	4
57	9.4646938	9.9807120	9.4839818	10.5160182	3
58	9.4651081	9.9806735	9.4844346	10.5155654	2
59	9.4655219	9.9806349	9.4848870	10.5151130	1
60	9.4659353	9.9805963	9 4853390	10.5146610	0
	Sine Comp	Sine	Tang. Com.	Tang.	Min.
	73 Degrees				

Min.	17 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4659353	9.9805963	9.4853390	10.5146610	60
1	9.4663483	9.9805577	9.4857907	10.5143093	59
2	9.4667609	9.9805190	9.4862419	10.5137581	58
3	9.4671730	9.9804803	9.4866928	10.5133072	57
4	9.4675848	9.9804415	9.4871433	10.5128567	56
5	9.4679960	9.9804027	9.4875933	10.5124067	55
6	9.4684069	9.9803639	9.4880430	10.5119570	54
7	9.4688173	9.9803250	9.4884924	10.5115076	53
8	9.4692273	9.9802860	9.4889413	10.5110587	52
9	9.4696369	9.9802471	9.4893898	10.5106102	51
10	9.4700461	9.9802081	9.4898380	10.5101620	50
11	9.4704548	9.9801690	9.4902858	10.5097142	49
12	9.4708631	9.9801299	9.4907332	10.5092668	48
13	9.4712710	9.9800908	9.4911802	10.5088198	47
14	9.4716785	9.9800516	9.4916269	10.5083731	46
15	9.4720856	9.9800124	9.4920731	10.5079269	45
16	9.4724922	9.9799732	9.4925190	10.5074810	44
17	9.4728985	9.9799339	9.4929646	10.5070354	43
18	9.4733043	9.9798946	9.4934097	10.5065903	42
19	9.4737097	9.9798552	9.4938545	10.5061455	41
20	9.4741146	9.9798158	9.4942988	10.5057012	40
21	9.4745192	9.9797764	9.4947429	10.5052571	39
22	9.4749234	9.9797369	9.4951865	10.5048135	38
23	9.4753271	9.9796793	9.4956298	10.5043702	37
24	9.4757304	9.9796578	9.4960727	10.5039273	36
25	9.4761334	9.9796182	9.4965152	10.5034848	35
26	9.4765359	9.9795785	9.4969574	10.5030426	34
27	9.4769380	9.9795388	9.4973991	10.5026009	33
28	9.4773396	9.9794991	9.4978406	10.5021594	32
29	9.4777409	9.9799593	9.4982816	10.5017184	31
30	9.4781418	9.9794195	9.4987223	10.5012777	30
31	9.4785423	9.9793796	9.4991626	10.5008374	29
32	9.4789423	9.9793398	9.4996026	10.5003974	28
33	9.4793420	9.9792998	9.5000422	10.4999578	27
34	9.4797412	9.9792599	9.5004814	10.4995136	26
35	9.4801401	9.9792198	9.5009203	10.4990797	25
36	9.4805385	9.9791798	9.5013588	10.4986412	24
37	9.4809366	9.9791397	9.5017969	10.4982031	23
38	9.4813342	9.9790996	9.5022347	10.4977653	22
39	9.4817315	9.9790594	9.5026721	10.4973279	21
40	9.4821283	9.9790191	9.5031092	10.4968908	20
41	9.4825248	9.9789789	9.5035459	10.4964541	19
42	9.4829208	9.9789386	9.5039822	10.4960178	18
43	9.4833165	9.9788983	9.5044182	10.4955818	17
44	9.4837117	9.9788579	9.5048538	10.4951462	16
45	9.4841066	9.9788175	9.5052891	10.4947109	15
46	9.4845010	9.9787770	9.5057240	10.4942760	14
47	9.4848951	9.9787365	9.5061586	10.4938414	13
48	9.4852888	9.9786960	9.5065928	10.4934072	12
49	9.4856820	9.9786554	9.5070267	10.4929733	11
50	9.4860749	9.9786148	9.5074602	10.4925398	10
51	9.4864674	9.9785741	9.5078933	10.4921067	9
52	9.4868595	9.9785334	9.5083261	10.4916739	8
53	9.4872512	9.9784927	9.5087586	10.4912414	7
54	9.4876426	9.9784519	9.5091907	10.4908093	6
55	9.4880335	9.9784111	9.5096224	10.4903776	5
56	9.4884240	9.9783702	9.5100539	10.4899461	4
57	9.4888142	9.9783293	9.5104849	10.4895151	3
58	9.4892040	9.9782883	9.5109156	10.4890844	2
59	9.4895934	9.9782474	9.5113460	10.4886540	1
60	9.4899824	9.9782063	9.5117760	10.4882240	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	72 Degrees				

Min.	18 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.4899824	9.9782062	9.5117760	10.4882240	60
1	9.4903710	9.9781653	9.5122057	10.4877943	59
2	9.4907592	9.9781241	9.5126351	10.4873649	58
3	9.4911471	9.9780830	9.5130641	10.4869359	57
4	9.4915345	9.9780418	9.5134927	10.4865073	56
5	9.4919216	9.9780006	9.5139210	10.4860790	55
6	9.4923083	9.9779593	9.5143490	10.4856510	54
7	9.4926946	9.9779180	9.5147766	10.4852234	53
8	9.4930806	9.9778766	9.5152039	10.4847961	52
9	9.4934661	9.9778353	9.5156309	10.4843691	51
10	9.4938513	9.9777938	9.5160575	10.4839425	50
11	9.4942361	9.9777523	9.5164838	10.4835162	49
12	9.4946205	9.9777108	9.5169097	10.4820903	48
13	9.4950046	9.9776693	9.5173353	10.4826647	47
14	9.4953883	9.9776277	9.5177606	10.4822394	46
15	9.4957716	9.9775860	9.5181855	10.4818145	45
16	9.4961545	9.9775444	9.5186101	10.4813899	44
17	9.4965370	9.9775026	9.5190344	10.4809656	43
18	9.4969192	9.9774609	9.5194583	10.4805417	42
19	9.4973010	9.9774191	9.5198819	10.4801181	41
20	9.4976824	9.9773772	9.5203052	10.4796948	40
21	9.4980635	9.9773354	9.5207282	10.4792718	39
22	9.4984442	9.9772934	9.5211508	10.4788492	38
23	9.4988245	9.9772515	9.5215730	10.4784270	37
24	9.4992045	9.9772095	9.5219950	10.4780050	36
25	9.4995840	9.9771674	9.5224166	10.4775834	35
26	9.4999633	9.9771253	9.5228379	10.4771621	34
27	9.5003421	9.9770832	9.5232589	10.4767411	33
28	9.5007206	9.9770410	9.5236795	10.4763205	32
29	9.5010987	9.9769988	9.5240999	10.4759001	31
30	9.5014764	9.9769566	9.5245199	10.4754801	30
31	9.5018538	9.9769143	9.5249395	10.4750605	29
32	9.5022308	9.9768720	9.5253589	10.4746411	28
33	9.5026075	9.9768296	9.5257779	10.4742221	27
34	9.5029838	9.9767872	9.5261966	10.4738034	26
35	9.5033597	9.9767447	9.5266150	10.4733850	25
36	9.5037353	9.9767022	9.5270331	10.4729669	24
37	9.5041105	9.9766597	9.5274508	10.4725492	23
38	9.5044853	9.9766171	9.5278682	10.4721318	22
39	9.5048598	9.9765745	9.5282853	10.4717147	21
40	9.5052339	9.9765318	9.5287021	10.4712979	20
41	9.5056077	9.9764891	9.5291186	10.4708814	19
42	9.5059811	9.9764464	9.5295347	10.4704653	18
43	9.5063542	9.9764036	9.5299505	10.4700495	17
44	9.5067268	9.9763608	9.5303661	10.4696339	16
45	9.5070992	9.9763179	9.5307813	10.4692187	15
46	9.5074712	9.9762750	9.5311961	10.4688039	14
47	9.5078428	9.9762321	9.5316107	10.4683893	13
48	9.5082141	9.9761891	9.5320250	10.4679750	12
49	9.5085850	9.9761461	9.5324389	10.4675611	11
50	9.5089556	9.9761030	9.5328526	10.4671474	10
51	9.5093258	9.9760599	9.5332659	10.4667341	9
52	9.5096956	9.9760167	9.5336789	10.4663211	8
53	9.5100651	9.9759736	9.5340916	10.4659084	7
54	9.5104343	9.9759303	9.5345040	10.4654960	6
55	9.5108031	9.9758870	9.5349161	10.4650839	5
56	9.5111716	9.9758437	9.5353278	10.4646722	4
57	9.5115397	9.9758004	9.5357393	10.4642607	3
58	9.5119074	9.9757570	9.5361505	10.4638495	2
59	9.5122749	9.9757135	9.5365613	10.4634387	1
60	9.5126419	9.9756701	9.5369719	10.4630281	0
	Sine Comp	Sine	Tang. Com.	Tang.	Min.
	71 Degrees				

Min.	19 Degrees				
	Sine	Sine Comp.	Tang	Tang. Comp.	
0	9.5126419	9.9756710	9.5369718	10.4630282	60
1	9.5130086	9.9756265	9.5373821	10.4626129	59
2	9.5133750	9.9755830	9.5377920	10.4621080	58
3	9.3137410	9.9755394	9.5382017	10.4617983	57
4	9.5141067	9.9754957	9.5386110	10.4613890	56
5	9.5144721	9.9754521	9.5390200	10.4609800	55
6	9.5148371	9.9754083	9.5394287	10.4605713	54
7	9.5152017	9.9753646	9.5398371	10.4601629	53
8	9.5155660	9.9753208	9.5402453	10.4597547	52
9	9.5159300	9.9752769	9.5406531	10.4593469	51
10	9.5162936	9.9752330	9.5410606	10.4589394	50
11	9.5166569	9.9751891	9.5414678	10.4585322	49
12	9.5170198	9.9751451	9.5418747	10.4581253	48
13	9.5173824	9.9751011	9.5422813	10.4577187	47
14	9.5177447	9.9750570	9.5426877	10.4573123	46
15	9.5181066	9.9750129	9.5430937	10.4569063	45
16	9.5184682	9.9749688	9.5434994	10.4565006	44
17	9.5188295	9.9749246	9.5439048	10.4560952	43
18	9.5191904	9.9748804	9.5443100	10.4556900	42
19	9.5195510	9.9747361	9.5447148	10.4552852	41
20	9.5199112	9.9747018	9.5451193	10.4548807	40
21	9.5202711	9.9747475	9.5455236	10.4544764	39
22	9.5206307	9.9747031	9.5459276	10.4540724	38
23	9.5209899	9.9746587	9.5463312	10.4536688	37
24	9.5213488	9.9746142	9.5467346	10.4532654	36
25	9.5217074	9.9745697	9.5471377	10.4528623	35
26	9.5220656	9.9745252	9.5475405	10.4524595	34
27	9.5224235	9.9744806	9.5479430	10.4520570	33
28	9.5227811	9.9744359	9.5483452	10.4516548	32
29	9.5231383	9.9743913	9.5487471	10.4512529	31
30	9.5234953	9.9743466	9.5491487	10.4508513	30
31	9.5238518	9.9743018	9.5495500	10.4504500	29
32	9.5242081	9.9742570	9.5499511	10.4500489	28
33	9.5245640	9.9742122	9.5503519	10.4496481	27
34	9.5249196	9.9741673	9.5507523	10.4492477	26
35	9.5252749	9.9741224	9.5511525	10.4488475	25
36	9.5256298	9.9740774	9.5515524	10.4484476	24
37	9.5259844	9.9740324	9.5519521	10.4480479	23
38	9.5263387	9.9739873	9.5523514	10.4476486	22
39	9.5266927	9.9739422	9.5527504	10.4472496	21
40	9.5270463	9.9738971	9.5531492	10.4468508	20
41	9.5273997	9.9738519	9.5535477	10.4464523	19
42	9.5277526	9.9738067	9.5539459	10.4460541	18
43	9.5281053	9.9737615	9.5543438	10.4456562	17
44	9.5284577	9.9737162	9.5547415	10.4452585	16
45	9.5288097	9.9736709	9.5551388	10.4448612	15
46	9.5291614	9.9736255	9.5555359	10.4444641	14
47	9.5295128	9.9735801	9.5559327	10.4440673	13
48	9.5298638	9.9735346	9.5563292	10.4436708	12
49	9.5302146	9.9734891	9.5567255	10.4432745	11
50	9.5305650	9.9734435	9.5571214	10.4428786	10
51	9.5309151	9.9733980	9.5575171	10.4424829	9
52	9.5312649	9.9733523	9.5579125	10.4420875	8
53	9.5316143	9.9733067	9.5583077	10.4416923	7
54	9.5319635	9.9732610	9.5587025	10.4412975	6
55	9.5323123	9.9732152	9.5590971	10.4409029	5
56	9.5326608	9.9731694	9.5594914	10.4405086	4
57	9.5330090	9.9731236	9.5598854	10.4401146	3
58	9.5333569	9.9730777	9.5602792	10.4397208	2
59	9.5337044	9.9730318	9.5606727	10.4393273	1
60	9.5340517	9.9739858	9.5610659	10.4389341	0
	Sine Comp	Sine	Tang. Com.	Tang.	Min.
	70 Degrees				

Min.	20 Degrees				
	Sine	Sine Comp.	Tang	Tang. Comp	
0	9.5340517	9.9729858	9.5610659	10.4389341	60
1	9.5343986	9.9729398	9.5614588	10.4385412	59
2	9.5347452	9.9728938	9.5618515	10.4381485	58
3	9.5350915	9.9728477	9.5622439	10.4377561	57
4	9.5354375	9.9728016	9.5626360	10.4373640	56
5	9.5357832	9.9727554	9.5630278	10.4369722	55
6	9.5361286	9.9727092	9.5634194	10.4365806	54
7	9.5364737	9.9726629	9.5638107	10.4361893	53
8	9.5368884	9.9726166	9.5642018	10.4357982	52
9	9.5371628	9.9725703	9.5645925	10.4354075	51
10	9.5375069	9.9725239	9.5649831	10.4350169	50
11	9.5378508	9.9724775	9.5653733	10.4346267	49
12	9.5381943	9.9724310	9.5657633	10.4342367	48
13	9.5385375	9.9723845	9.5661530	10.4338470	47
14	9.5388804	9.9723380	9.5665424	10.4334576	46
15	9.5392230	9.9722914	9.5669316	10.4330684	45
16	9.5395653	9.9722448	9.5673205	10.4326795	44
17	9.5399073	9.9721981	9.5677091	10.4322909	43
18	9.5402489	9.9721514	9.5680975	10.4319025	42
19	9.5405903	9.9721047	9.5684856	10.4315144	41
20	9.5409314	9.9720579	9.5688735	10.4311265	40
21	9.5412721	9.9720110	9.5692611	10.4307389	39
22	9.5416126	9.9719642	9.5696484	10.4303516	38
23	9.5419527	9.9719172	9.5700355	10.4299645	37
24	9.5422926	9.9718703	9.5704223	10.4295777	36
25	9.5426321	9.9718233	9.5708088	10.4291912	35
26	9.5429713	9.9717762	9.5711951	10.4288049	34
27	9.5433103	9.9717291	9.5715811	10.4284189	33
28	9.5436489	9.9716820	9.5719669	10.4280331	32
29	9.5439873	9.9716348	9.5723524	10.4276476	31
30	9.5443523	9.9715876	9.5727377	10.4272623	30
31	9.5446630	9.9715404	9.5731227	10.4268773	29
32	9.5450005	9.9714931	9.5735074	10.4264926	28
33	9.5453376	9.9714457	9.5738919	10.4261081	27
34	9.5456745	9.9713984	9.5742761	10.4257239	26
35	9.5460110	9.9713509	9.5746601	19.4253399	25
36	9.5463472	9.9713035	9.5750438	10.4249562	24
37	9.5466832	9.9712560	9.5754272	10.4245728	23
38	9.5470189	9.9712084	9.5758104	10.4241896	22
39	9.5473542	9.9711608	9.5761934	10.4238066	21
40	9.5476893	9.9711132	9.5765761	10.4234239	20
41	9.5480240	9.9710655	9.5769595	10.4230415	19
42	9.5483585	9.9710178	9.5773407	10.4226593	18
43	9.5486927	9.9709701	9.5777226	10.4222774	17
44	9.5490266	9.9709223	9.5781043	10.4218957	16
45	9.5493602	9.9708744	9.5784858	10.4215142	15
46	9.5496935	9.9708265	9.5788669	10.4211331	14
47	9.5500265	9.9707786	9.5792479	10.4207521	13
48	9.5503592	9.9707306	9.5796286	10.4203714	12
49	9.5506916	9.9706826	9.5800090	10.4199910	11
50	9.5510237	9.9706346	9.5803892	10.4196108	10
51	9.5513556	9.9705865	9.5807691	10.4192309	9
52	9.5516871	9.9705383	9.5811488	10.4188512	8
53	9.5520184	9.9704902	9.5815282	10.4184718	7
54	9.5523494	9.9704419	9.5819074	10.4180926	6
55	9.5526801	9.9703937	9.5822864	10.4177136	5
56	9.5530105	9.9703454	9.5826651	10.4173349	4
57	9.5533406	9.9702970	9.5830435	10.4169565	3
58	9.5536704	9.9702486	9.5834217	10.4165783	2
59	9.5539999	9.9702002	9.5837997	10.4162003	1
60	9.5543292	9.9701517	9.5841774	10.4158226	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	69 Degrees				

Min.	21 Degrees				
	Sine	Sine Comp.	Tang	Tang. Comp.	
0	9.5543292	9.9701517	9.5841774	10.4158226	60
1	9.5546581	9.9701032	9.5845549	10.4154451	59
2	9.5549868	9.9700547	9.5849321	10.4150679	58
3	9.5553152	9.9700061	9.5853091	10.4146909	57
4	9.5556433	9.9699574	9.5856859	10.4143141	56
5	9.5559711	9.9699087	9.5860624	10.4139376	55
6	9.5562987	9.9698600	9.5864386	10.4135614	54
7	9.5566259	9.9698112	9.5868147	10.4131853	53
8	9.5569529	9.9697624	9.5871904	10.4128096	52
9	9.5572796	9.9697136	9.5875660	10.4124340	51
10	9.5576060	9.9696647	9.5879413	10.4120587	50
11	9.5579321	9.9696158	9.5883163	10.4116837	49
12	9.5582579	9.9695668	9.5886912	10.4113088	48
13	9.5585835	9.9695177	9.5890657	10.4109343	47
14	9.5589088	9.9694687	9.5894401	10.4105599	46
15	9.5592338	9.9694196	9.5898142	10.4101858	45
16	9.5595585	9.9693704	9.5901881	10.4098119	44
17	9.5598829	9.9693212	9.5905617	10.4094383	43
18	9.5602071	9.9692720	9.5909351	10.4090649	42
19	9.5605310	9.9692227	9.5913082	10.4086918	41
20	9.5608546	9.9691734	9.5916812	10.4083188	40
21	9.5611779	9.9691241	9.5920539	10.4079461	39
22	9.5615010	9.9690746	9.5924263	10.4075737	38
23	9.5618237	9.9690252	9.5927985	10.4072015	37
24	9.5621462	9.9689757	9.5931705	10.4068295	36
25	9.5624685	9.9689262	9.5935423	10.4064577	35
26	9.5627904	9.9688766	9.5939138	10.4060862	34
27	9.5631121	9.9688270	9.5942851	10.4057149	33
28	9.5634335	9.9687773	9.5946561	10.4053439	32
29	9.5637546	9.9687276	9.5950269	10.4049731	31
30	9.5640754	9.9686779	9.5953975	10.4046025	30
31	9.5643960	9.9686281	9.5957679	10.4042321	29
32	9.5647163	9.9685783	9.5961380	10.4038620	28
33	9.5650363	9.9685284	9.5965079	10.4034921	27
34	9.5653561	9.9684785	9.5968776	10.4031224	26
35	9.5656756	9.9684286	9.5972470	10.4027530	25
36	9.5659948	9.9683786	9.5976162	10.4023838	24
37	9.5663137	9.9683285	9.5979852	10.4020148	23
38	9.5666324	9.9682784	9.5983540	10.4016460	22
39	9.5669508	9.9682283	9.5987225	10.4012775	21
40	9.5672689	9.9681781	9.5990908	10.4009092	20
41	9.5675868	9.9681279	9.5994588	10.4005412	19
42	9.5679044	9.9680777	9.5998267	10.4001733	18
43	9.5682217	9.9680274	9.6001943	10.3998057	17
44	9.5685387	9.9679771	9.6005617	10.3994383	16
45	9.5688555	9.9679267	9.6009289	10.3990711	15
46	9.5691721	9.9678763	9.6012958	10.3987042	14
47	9.5694883	9.9678258	9.6016625	10.3983375	13
48	9.5698043	9.9677753	9.6020290	10.3979710	12
49	9.5701200	9.9677247	9.6023953	10.3976047	11
50	9.5704355	9.9676741	9.6027613	10.3972387	10
51	9.5707506	9.9676235	9.6031271	10.3968729	9
52	9.5710656	9.9675728	9.6034927	10.3965073	8
53	9.5713802	9.9675221	9.6038581	10.3961419	7
54	9.5716946	9.9674713	9.6042233	10.3957767	6
55	9.5720087	9.9674205	9.6045882	10.3954118	5
56	9.5723226	9.9673697	9.6049529	10.3950471	4
57	9.5726362	9.9673188	9.6053174	10.3946826	3
58	9.5729495	9.9672679	9.6056817	10.3943183	2
59	9.5732626	9.9672169	9.6060457	10.3939543	1
60	9.5735754	9.9671659	9.6064096	10.3935904	0
	Sine Comp.	Sine	Tang. Com	Tang.	Min.
	68 Degrees				

Min.	22 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5735754	9.9671659	9.6064096	10.3935904	60
1	9.5738880	9.9671148	9.6067732	10.3932268	59
2	9.5742003	9.9670637	9.6071366	10.3928634	58
3	9.5745123	9.9670125	9.6074997	10.3925003	57
4	9.5748240	9.9669614	9.6078627	10.3921373	56
5	9.5751356	9.9669101	9.6082254	10.3917746	55
6	9.5754468	9.9668588	9.6085880	10.3914120	54
7	9.5757578	9.9668075	9.6089503	10.3910497	53
8	9.5760685	9.9667562	9.6093124	10.3906876	52
9	9.5763790	9.9667048	9.6096742	10.3903258	51
10	9.5766892	9.9666533	9.6100359	10.3899641	50
11	9.5769991	9.9666018	9.6103973	10.3896027	49
12	9.5773088	9.9665503	9.6107586	10.3892414	48
13	9.5776183	9.9664986	9.6111196	10.3888804	47
14	9.5779275	9.9664471	9.6114804	10.3885196	46
15	9.5782364	9.9663954	9.6118409	10.3881591	45
16	9.5785450	9.9663437	9.6122013	10.3877987	44
17	9.5788535	9 9662920	9.6125615	10.3874385	43
18	9.5791616	9 9662402	9.6129214	10.3870786	42
19	9.5794695	9.9661884	9.6132812	10.3867188	41
20	9.5797772	9.9661365	9.6136407	10.3863593	40
21	9.5800845	9.9660846	9.6140000	10.3860000	39
22	9.5803917	9.9660326	9.6143591	10.3856409	38
23	9.5806986	9.9659806	9.6147180	10.3852820	37
24	9.5810052	9.9659285	9.6150766	10.3849234	36
25	9.5813116	9.9658764	9.6154351	10.3845649	35
26	9.5816177	9.9658243	9.6157934	10.3842066	34
27	9.5819236	9.9657721	9.6161514	10.3838486	33
28	9.5822292	9.9657199	9.6165093	10.3834907	32
29	9.5825345	9.9656677	9.6168669	10.3831331	31
30	9.5828397	9.9656153	9.6172243	10.3827757	30
31	9.5831445	9.9655630	9.6175815	10.3824185	29
32	9.5834491	9.9655106	9.6179385	10.3820615	28
33	9.5837535	9.9654582	9.6182953	10.3817047	27
34	9.5840576	9.9654057	9.6186519	10.3813481	26
35	9.5843615	9.9653532	9.6190083	10.3809917	25
36	9.5846651	9.9653006	9.6193645	10.3806355	24
37	9.5849685	9.9652480	9.6197205	10.3802795	23
38	9.5852716	9.9651953	9.6200762	10.3799238	22
39	9.5855745	9.9651426	9.6204318	10.3795682	21
40	9.5858771	9.9650899	9.6207872	10.3792128	20
41	9.5861795	9.9650371	9.6211423	10.3788577	19
42	9.5864816	9.9649843	9.6214974	10.3785026	18
43	9.5867835	9.9649314	9.6218520	10.3781480	17
44	9 5870851	9.9648785	9.6222066	10.3777934	16
45	9.5873865	9.9648256	9.6225609	10.3774391	15
46	9.5876876	9.9647726	9.6229150	10.3770850	14
47	9.5879885	9.9647195	9.6232690	10.3767310	13
48	9.5882892	9.9646665	9.6236227	10.3763773	12
49	9.5885896	9.9646133	9.6239763	10.3760237	11
50	9.5888897	9.9645602	9.6243296	10.3756704	10
51	9.5891897	9.9645069	9.6246827	10.3753173	9
52	9.5894893	9.9644537	9.6250356	10.3749644	8
53	9.5897888	9.9644004	9.6253884	10 3746116	7
54	9.5900880	9.9643470	9.6257409	10.3742591	6
55	9.5903869	9.9642937	9.6260932	10.3739068	5
56	9.5906856	9.9642402	9.6264454	10.3735546	4
57	9.5909841	9.9641868	9 6267973	10.3732027	3
58	9.5912823	9.9641332	9.6271491	10.3728509	2
59	9.5915803	9.9640797	9.6275006	10.3724994	1
60	9.5918780	9 9640261	9.6278519	10.3721481	0
	Sine Comp.	Sine	Tang. Com·	Tang.	Min.
	67 Degrees				

Min.	23 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.5918780	9.9640261	9.6278519	10.3721481	60
1	9.5921755	9.9639724	9.6282031	10.3717969	59
2	9.5924728	9.9639187	9.6285540	10.3714460	58
3	9.5927698	9.9638650	9.6289048	10.3710952	57
4	9.5930666	9.9638112	9.6292553	10.3707447	56
5	9.5933631	9.9637574	9.6296057	10.3703943	55
6	9.5936594	9.9637036	9.6299558	10.3700442	54
7	9.5939555	9.9636496	9.6303058	10.3696942	53
8	9.5942513	9.9635957	9.6306556	10.3693444	52
9	9.5945469	9.9635417	9.6310052	10.3689948	51
10	9.5948422	9.9634877	9.6313545	10.3686455	50
11	9.5951373	9.9634336	9.6317037	10.3682963	49
12	9.5954322	9.9633795	9.6320527	10.3679473	48
13	9.5957268	9.9633253	9.6324015	10.3675985	47
14	9.5960212	9.9632711	9.6327501	10.3672499	46
15	9.5963154	9.9632168	9.6330985	10.3669015	45
16	9.5966093	9.9631625	9.6334468	10.3665532	44
17	9.5969030	9.9631082	9.6337948	10.3662052	43
18	9.5971965	9.9630538	9.6341426	10.3658574	42
19	9.5974897	9.9629994	9.6344903	10.3655097	41
20	9.5977827	9.9629449	9.6348378	10.3651622	40
21	9.5980754	9.9628904	9.6351850	10.3648150	39
22	9.5983679	9.9628358	9.6355321	10.3644679	38
23	9.5986602	9.9627812	9.6358790	10.3641210	37
24	9.5989523	9.9627266	9.6362257	10.3637743	36
25	9.5992441	9.9626719	9.6365722	10.3634278	35
26	9.5995357	9.9626172	9.6369185	10.3630815	34
27	9.5998271	9.9625624	9.6372646	10.3627354	33
28	9.6001181	9.9625076	9.6376106	10.3623894	32
29	9.6004090	9.9624527	9.6379563	10.3620437	31
30	9.6006997	9.9623978	9 6383019	10.3616981	30
31	9.6009901	9.9623428	9.6386473	10.3613527	29
32	9.6012803	9.9622878	9.6389925	10.3610075	28
33	9.6015703	9.9622328	9.6393375	10.3606625	27
34	9.6018600	9.9621777	9.6396823	10.3603177	26
35	9.6021495	9.9621226	9.6400269	10.3599731	25
36	9.6024388	9.9620674	9.6403714	10.3596286	24
37	9.6027278	9.9620112	9.6407156	10.3592844	23
38	9.6030166	9.9619569	9.6410597	10.3589403	22
39	9.6033052	9.9619016	9.6414036	10.3585964	21
40	9.6035936	9.9618463	9.6417473	10.3582527	20
41	9.6038817	9.9617900	9.6420908	10.3579092	19
42	9.6041696	9.9617355	9.6424342	10.3575658	18
43	9.6044573	9.9616800	9.6427773	10.3572227	17
44	9.6047448	9.9616245	9.6431203	10.3568797	16
45	9.6050320	9.9615689	9.6434631	10.3565369	15
46	9.6053190	9.9615133	9.6448057	10.3561943	14
47	9.6056057	9.9614576	9.6441481	10.3558519	13
48	9.6058923	9.9614020	9.6444903	10.3550597	12
49	9.6061786	9.9613463	9.6448324	10.3551676	11
50	9.6064647	9.9612904	9 6451743	10.3548257	10
51	9.6067506	9.9612346	9.6455160	10.3544840	9
52	9.6070362	9.9611787	9.6458575	10.3541425	8
53	9.6073216	9.9611228	9.6461988	10.3538012	7
54	9.6076068	9.9610668	9.6465400	10.3534600	6
55	9.6078918	9.9610108	9.6468810	10.3531190	5
56	9.6081765	9.9609548	9.6472217	10.3527783	4
57	9.6084611	9.9608987	9.6475624	10.3524376	3
58	9.6087454	9.9608426	9.6479028	10.3520972	2
59	9.6090294	9.9607864	9.6482431	10.3517569	1
60	9.6093133	9.9607302	9.6485831	10.3514169	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	66 Degrees				

Min.	24 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.6093133	9.9607302	9.6485831	10.3514169	60
1	9.6095969	9.9606739	9.6489230	10.3510770	59
2	9.6098803	9.9606176	9.6492628	10.3507372	58
3	9.6101635	9.9605612	9.6496023	10.3503977	57
4	9.6104465	9.9605048	9.6499417	10.3500583	56
5	9.6107293	9.9604484	9.6502809	10.3497191	55
6	9.6110118	9.9603919	9.6506199	10.3493801	54
7	9.6112941	9.9603354	9.6509587	10.3490413	53
8	9.6115762	9.9602788	9.6512974	10.3487026	52
9	9.6118580	9.9602222	9.6516359	10.3483641	51
10	9.6121397	9.9601655	9.6519742	10.3480258	50
11	9.6124211	9.9601088	9.6523123	10.3476877	49
12	9.6127023	9.9600520	9.6526503	10.3473497	48
13	9.6129833	9.9599952	9.6529881	10.3470119	47
14	9.6132641	9.9599384	9.6533257	10.3466743	46
15	9.6135446	9.9598815	9.6536631	10.3463369	45
16	9.6138250	9.9598246	9.6540004	10.3459996	44
17	9.6141051	9.9597676	9.6543375	10.3456625	43
18	9.6143850	9.9597106	9.6546744	10.3453256	42
19	9.6146647	9.9596535	9.6550112	10.3449888	41
20	9.6149441	9.9595964	9.6553477	10.3446523	40
21	9.6152234	9.9595393	9.6556841	10.3443159	39
22	9.6155024	9.9594821	9.6560204	10.3439796	38
23	9.6157812	9.9594248	9.6563564	10.3436436	37
24	9.6160598	9.9593675	9.6566923	10.3433077	36
25	9.6163382	9.9593102	9.6570280	10.3429720	35
26	9.6166164	9.9592528	9.6573636	10.3426364	34
27	9.6168944	9.9591954	9.6576989	10.3423011	33
28	9.6171721	9.9591380	9.6580341	10.3419659	32
29	9.6174496	9.9590805	9.6583692	10.3416308	31
30	9.6177270	9.9590229	9.6587041	10.3412960	30
31	9.6180041	9.9589653	9.6590387	10.3409613	29
32	9.6182809	9.9589077	9.6593733	10.3406267	28
33	9.6185576	9.9588500	9.6597076	10.3402924	27
34	9.6188341	9.9587923	9.6600418	10.3399582	26
35	9.6191103	9.9587345	9.6603758	10.3396242	25
36	9.6193864	9.9586767	9.6607097	10.3392903	24
37	9.6196622	9.9586188	9.6610434	10.3389566	23
38	9.6199378	9.9585609	9.6613769	10.3386231	22
39	9.6202132	9.9585030	9.6617103	10.3382897	21
40	9.6204884	9.9584450	9.6620434	10.3379566	20
41	9.6207634	9.9583869	9.6623765	10.3376235	19
42	9.6210382	9.9583288	9.6627093	10.3372907	18
43	9.6213127	9.9582707	9.6630420	10.3369580	17
44	9.6215871	9.9582125	9.6633745	10.3366255	16
45	9.6218612	9.9581543	9.6637069	10.3362931	15
46	9.6221351	9.9580961	9.6640391	10.3359609	14
47	9.6224088	9.9580378	9.6643711	10.3356289	13
48	9.6226824	9.9579794	9.6647030	10.3352970	12
49	9.6229557	9.9579210	9.6650346	10.3349654	11
50	9.6232287	9.9578626	9.6653662	10.3346338	10
51	9.6235016	9.9578041	9.6656975	10.3343025	9
52	9.6237743	9.9577456	9.6660288	10.3339712	8
53	9.6240467	9.9576870	9.6663598	10.3336402	7
54	9.6243190	9.9576284	9.6666907	10.3333093	6
55	9.6245911	9.9575697	9.6670214	10.3329786	5
56	9.6248629	9.9575110	9.6673519	10.3326481	4
57	9.6251346	9.9574522	9.6676823	10.3323177	3
58	9.6254060	9.9573934	9.6680126	10.3319874	2
59	9.6256772	9.9573346	9.6683426	10.3316574	1
60	9.6259483	9.9572757	9.6686725	10.3313275	0
	Sine Comp.	Sine	Tang. Com	Tang.	Min.
	65 Degrees				

Min.	25 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.6259483	9.9572757	9.6686725	10.3313275	60
1	9.6262191	9.9572168	9.6690023	10.3309977	59
2	9.6264897	9.9571578	9.6693319	10.3306681	58
3	9.6267601	9.9570988	9.6696613	10.3303387	57
4	9.6270303	9.9570397	9.6699906	10.3300094	56
5	9.6273003	9.9569806	9.6703197	10.3296803	55
6	9.6275701	9.9569215	9.6706486	10.3293514	54
7	9.6278397	9.9568623	9.6709774	10.3290226	53
8	9.6281090	9.9568030	9.6713060	10.3286940	52
9	9.6283782	9.9567437	9.6716345	10.3283655	51
10	9.6286472	9.9566844	9.6719628	10.3280372	50
11	9.6289160	9.9566250	9.6722910	10.3277090	49
12	9.6291845	9.9565656	9.6726190	10.3273810	48
13	9.6294529	9.9565061	9.6729468	10.3270532	47
14	9.6297211	9.9564466	9.6732745	10.3267255	46
15	9.6299890	9.9563870	9.6736020	10.3263980	45
16	9.6302568	9.9563274	9.6739294	10.3260706	44
17	9.6305243	9.9562678	9.6742566	10.3257434	43
18	9.6307917	9.9562081	9.6745836	10.3254164	42
19	9.6310589	9.9561483	9.6749105	10.3250895	41
20	9.6313258	9.9560886	9.6752372	10.3247628	40
21	9.6315926	9.9560287	9.6755638	10.3244362	39
22	9.6318591	9.9559689	9.6758903	10.3241097	38
23	9.6321255	9.9559089	9.6762165	10.3237835	37
24	9.6323916	9.9558490	9.6765426	10.3234574	36
25	9.6326576	9.9557890	9.6768686	10.3231314	35
26	9.6329233	9.9557289	9.6771944	10.3228056	34
27	9.6331889	9.9556688	9 6775201	10.3224799	33
28	9.6334542	9.9556087	9.6778456	10.3221544	32
29	9.6337194	9.9555485	9.6781709	10.3218291	31
30	9.6339844	9.9554882	9.6784961	10.3215039	30
31	9.6342491	9.9554280	9.6788211	10.3211789	29
32	9.6345137	9.9553676	9.6791460	10.3208540	28
33	9.6347780	9.9553073	9.6794708	10.3205292	27
34	9.6350422	9.9552469	9.6797953	10.3202047	26
35	9.6353062	9.9551864	9.6801188	10.3198802	25
36	9.6355699	9.9551259	9.6804440	10.3195560	24
37	9.6358335	9.9550653	9.6807682	10.3192318	23
38	9.6360969	9.9550047	9.6810921	10.3189079	22
39	9.6363601	9.9549441	9.6814160	10.3185840	21
40	9.6366231	9.9548834	9.6817396	10.3182604	20
41	9.6368859	9.9548227	9.6820632	10.3179368	19
42	9.6371484	9.9547619	9.6823865	10.3176135	18
43	9.6374108	9.9547011	9.6827098	10.3172902	17
44	9.6376731	9.9546402	9.6830328	10.3169672	16
45	9.6379351	9.954579	9.6833557	10.3166443	15
46	9.6381969	9.9545184	9.6836785	10.3163215	14
47	9.6384585	9.9544574	9.6840011	10.3159989	13
48	9.6387199	9.9543963	9.6843236	10.3156764	12
49	9.6389812	9.9543352	9.6846459	10.3153541	11
50	9.6392422	9.9542741	9.6849681	10.3150319	10
51	9.6395030	9.9542129	9.6852901	10.3147099	9
52	9.6397637	9.9541517	9.6856120	10.3143880	8
53	9.6400241	9.9540904	9.6859338	10.3140662	7
54	9.6402844	9.9540291	9.6862553	10.3137447	6
55	9.6405445	9.9539677	9.6865768	10.3134232	5
56	9.6408044	9.9539063	9.6868981	10.3131019	4
57	9.6410640	9.9538448	9.6872192	10.3127808	3
58	9.6413235	9.9537833	9.6875402	10.3124598	2
59	9.6415828	9.9537218	9.6878611	10.3121389	1
60	9.6418420	9.9536602	9.6881818	10.3118182	0
	Sine Comp.	Sine	Tang. Com	Tang.	Min.
	64 Degrees				

Min.	26 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.6418420	9.9536602	9.6881818	10.3118182	60
1	9.6421009	9.9535985	9.6885023	10.3114977	59
2	9.6423596	9.9535369	9.6888227	10.3111773	58
3	9.6426182	9.9534751	9.6891430	10.3108570	57
4	9.6428765	9.9534134	9.6894631	10.3105369	56
5	9.6431347	9.9533515	9.6897831	10.3102169	55
6	9.6433926	9.9532897	9.6901030	10.3098970	54
7	9.6436504	9.9532278	9.6904226	10.3095774	53
8	9.6439080	9.9531658	9.6907422	10.3092578	52
9	9.6441654	9.9531038	9.6910616	10.3089384	51
10	9.6444226	9.9530418	9.6913809	10.3086191	50
11	9.6446796	9.9529797	9.6917000	10.3083000	49
12	9.6449365	9.9529175	9.6920189	10.3079811	48
13	9.6451931	9.9528553	9.6923378	10.3076622	47
14	9.6454496	9.9527931	9.6926565	10.3073435	46
15	9.6457058	9.9527308	9.6929750	10.3070250	45
16	9.6459619	9.9526685	9.6932934	10.3067066	44
17	9.6462178	9.9526061	9.6936117	10.3063883	43
18	9.6464735	9.9525437	9.6939298	10.3060702	42
19	9.6467290	9.9524813	9.6942478	10.3057522	41
20	9.6469844	9.9524188	9.6945656	10.3054344	40
21	9.6472395	9.9523562	9.6948833	10.3051167	39
22	9.6474945	9.9522936	9.6952099	10.3047991	38
23	9.6477492	9.9522310	9.6955183	10.3044817	37
24	9.6480038	9.9521683	9.6958355	10.3041645	36
25	9.6482582	9.9521055	9.6961527	10.3038473	35
26	9.6485124	9.9520428	9.6964697	10.3035303	34
27	9.6487665	9.9519799	9.6967865	10.3032135	33
28	9.6490203	9.9519171	9.6971032	10.3028968	32
29	9.6492740	9.9518541	9.6974198	10.3025802	31
30	9.6495274	9.9517912	9.6977363	10.3022637	30
31	9.6497807	9.9517282	9.6980526	10.3019474	29
32	9.6500338	9.9516651	9.6983687	10.3016313	28
33	9.6502868	9.9516020	9.6986847	10.3013153	27
34	9.6505395	9.9515389	9.6990006	10 3009994	26
35	9.6507920	9.9514757	9.6993164	10.3006836	25
36	9.6510444	9.9514124	9.6996320	10.3003680	24
37	9.6512966	9.9513492	9.6999474	10.3000526	23
38	9.6515486	9.9512858	9.7002628	10.2997372	22
39	9.6518004	9.9512224	9.7005780	10.2994220	21
40	9.6520521	9.9511590	9.7008930	10.2991070	20
41	9.6523035	9.9510956	9.7012080	10.2987920	19
42	9.6525548	9.9510320	9.7015227	10.2984773	18
43	9.6528059	9.9509685	9.7018374	10.2981626	17
44	9.6530568	9.9509049	9.7021519	10.2978481	16
45	9.6533075	9.9508412	9.7024663	10.2975337	15
46	9.6535581	9.9507775	9.7027805	10.2972195	14
47	9.6538084	9.9507138	9.7030946	10.2969054	13
48	9.6540586	9.9506500	9.7034086	10.2965914	12
49	9.6543086	9.9505861	9.7037225	10.2962775	11
50	9.6545584	9.9505223	9.7040362	10.2959638	10
51	9.6548081	9.9504583	9.7043497	10.2956503	9
52	9.6550575	9.9503944	9.7046632	10.2953368	8
53	9.6553068	9.9503303	9.7049765	10.2950235	7
54	9.6555559	9.9502663	9.7052897	10.2947103	6
55	9.6558048	9.9502022	9.7056027	10.2943973	5
56	9.6560536	9.9501380	9.7059156	10.2940844	4
57	9.6563021	9.9500738	9.7062284	10.2937716	3
58	9.6565505	9.9500095	9.7065410	10.2934590	2
59	9.6567987	9.9499452	9.7068535	10.2931465	1
60	9.6570468	9.9498809	9.7071659	10.2928341	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	63 Degrees				

Min.	27 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.6570468	9.9498809	9.7071659	10.2928341	60
1	9.6572946	9.9498165	9.7074781	10.2925219	59
2	9.6575423	9.9497521	9.7077902	10.2922098	58
3	9.6577898	9.9496876	9.7081022	10.2918978	57
4	9.6580371	9.9496230	9.7084141	10.2915859	56
5	9.6582842	9.9495585	9.7087258	10.2912752	55
6	9.6585312	9.9494938	9.7090374	10.2909626	54
7	9.6587780	9.9494292	9.7093488	10.2906512	53
8	9.6590246	9.9493645	9.7096601	10.2903399	52
9	9.6592710	9.9492997	9.7099713	10.2900287	51
10	9.6595173	9.9492349	9.7102824	10.2897176	50
11	9.6597634	9.9491700	9.7105933	10.2894067	49
12	9.6600093	9.9491051	9.7109041	10.2890959	48
13	9.6602550	9.9490402	9.7112148	10.2887852	47
14	9.6605005	9.9489752	9.7115254	10.2884746	46
15	9.6607459	9.9489101	9.7118358	10.2881642	45
16	9.6609911	9.9488450	9.7121461	10.2878539	44
17	9.6612361	9.9487799	9.7124562	10.2875438	43
18	9.6614810	9.9487147	9.7127662	10.2872338	42
19	9.6617257	9.9486495	9.7130761	10.2869239	41
20	9.6619702	9.9485842	9.7133859	10.2866141	40
21	9.6622145	9.9485189	9.7136956	10.2863044	39
22	9.6624586	9.9484535	9.7140051	10.2859949	38
23	9.6627026	9.9483881	9.7143145	10.2856855	37
24	9.6629464	9.9483227	9.7146237	10.2853763	36
25	9.6631900	9.9482572	9.7149329	10.2850671	35
26	9.6634335	9.9481916	9.7152419	10.2847581	34
27	9.6636768	9.9481260	9.7155508	10.2844492	33
28	9.6639199	9.9480604	9.7158595	10.2841405	32
29	9.6641628	9.9479947	9.7161682	10.2838318	31
30	9.6644056	9.9479289	9.7164767	10.2835233	30
31	9.6646482	9.9478631	9.7167851	10.2832149	29
32	9.6648906	9.9477973	9.7170933	10.2829067	28
33	9.6651329	9.9477314	9.7174014	10.2825986	27
34	9.6653749	9.9476655	9.7177094	10.2822906	26
35	9.6656168	9.9475995	9.7180173	10.2819827	25
36	9.6658586	9.9475335	9.7183251	10.2816749	24
37	9.6661001	9.9474674	9.7186327	10.2813673	23
38	9.6663415	9.9474013	9.7189402	10.2810598	22
39	9.6665828	9.9473352	9.7192476	10.2807524	21
40	9.6668238	9.9472689	9.7195549	10.2804451	20
41	9.6670647	9.9472027	9.7198620	10.2801380	19
42	9.6673054	9.9471364	9.7201690	10.2798310	18
43	9.6675459	9.9470700	9.7204759	10.2795241	17
44	9.6677863	9.9470036	9 7207827	10.2792173	16
45	9.6680265	9.9469372	9.7210893	10.2789107	15
46	9.6682665	9.9468707	9.7213958	10.2786042	14
47	9.6685064	9.9468042	9.7217022	10.2782978	13
48	9.6687461	9.9467376	9.7220085	10.2779915	12
49	9.6689856	9.9466710	9.7223147	10.2776853	11
50	9.6692250	9.9466043	9.7226207	10.2773793	10
51	9.6694642	9.9465376	9.7229266	10.2770734	9
52	9.6697032	9.9464708	9.7232324	10.2767676	8
53	9.6699420	9.9464040	9.7235381	10.2764619	7
54	9.6701807	9.9463371	9.7238436	10.2761564	6
55	9.6704192	9.9462702	9.7241490	10.2758510	5
56	9.6706576	9.9462032	9.7244543	10.2755457	4
57	9.6708958	9.9461362	9.7247595	10.2752405	3
58	9.6711338	9.9460692	9.7250646	10.2749354	2
59	9.6713716	9.9460021	9.7253695	10.2746305	1
60	9.6716093	9.9469349	9.7256744	10.2743256	0
	Sine Comp	Sine	Tang. Com.	Tang.	Min.
	62 Degrees				

Min.	28 Degrees				
	Sine	Sine Comp.	Tang.	Tang Comp.	
0	9.6716093	9.9459349	9.7256744	10.2743256	60
1	9.6718468	9.9458677	9.7259791	10.2740209	59
2	9.6720841	9.9458005	9.7262837	10.2737163	58
3	9.6723213	9.9457332	9.7265881	10.2734119	57
4	9.6725583	9.9456659	9.7268925	10.2731075	56
5	9.6727952	9.9455985	9.7271967	10.2728033	55
6	9.6730319	9.9455310	9.7275008	10.2724992	54
7	9.6732684	9.9454636	9.7278048	10.2721952	53
8	9.6735047	9.9453960	9.7281087	10.2718913	52
9	9.6737409	9.9453285	9.7284124	10.2715876	51
10	9.6739769	9.9452609	9.7287161	10.2712839	50
11	9.6742128	9.9451932	9.7290196	10.2709804	49
12	9.6744485	9.9451255	9.7293230	10.2706770	48
13	9.6746840	9.9450577	9.7296263	10.2703737	47
14	9.6749194	9.9449899	9.7299295	10.2700705	46
15	9.6751546	9.9449220	9.7302325	10.2697675	45
16	9.6753896	9.9448541	9.7305354	10.2694646	44
17	9.6756245	9.9447862	9.7308383	10.2691617	43
18	9.6758592	9.9447182	9.7311410	10.2688590	42
19	9.6760937	9.9446501	9.7314436	10.2685564	41
20	9.6763281	9.9445821	9.7317460	10.2682540	40
21	9.6765623	9.9445139	9.7320484	10.2679516	39
22	9.6767963	9.9444457	9.7323506	10.2676494	38
23	9.6770302	9.9443775	9.7326527	10.2673473	37
24	9.6772640	9.9443092	9.7329547	10.2670453	36
25	9.6774975	9.9442409	9.7332566	10.2667434	35
26	9.6777309	9.9441725	9.7335584	10.2664416	34
27	9.6779642	9.9441041	9.7338601	10.2661399	33
28	9.6781972	9.9440356	9.7341616	10.2658384	32
29	9.6784301	9.9439671	9.7344631	10.2655369	31
30	9.6786629	9.9438985	9.7347644	10.2652356	30
31	9.6788955	9.9438299	9.7350656	10.2649344	29
32	9.6791279	9.9437612	9.7353667	10.2646333	28
33	9.6793602	9.9436925	9.7356677	10.2643323	27
34	9.6795923	9.9436238	9.7359685	10.2640315	26
35	9.6798243	9.9435549	9.7362693	10.2637307	25
36	9.6800560	9.9434861	9.7365699	10.2634301	24
37	9.6802877	9.9434172	9.7368705	10.2631295	23
38	9.6805191	9.9433482	9.7371709	10.2628291	22
39	9.6807504	9.9432792	9.7374712	10.2625288	21
40	9.6809816	9.9432102	9.7377714	10.2622286	20
41	9.6812126	9.9431411	9.7380715	10.2619285	19
42	9.6814434	9.9430720	9.7383714	10.2616286	18
43	9.6816741	9.9430028	9.7386713	10.2613287	17
44	9.6819046	9.9429335	9.7389710	10.2610290	16
45	9.6821349	9.9428643	9.7392707	10.2607293	15
46	9.6823651	9.9427949	9.7395702	10.2604298	14
47	9.6825952	9.9427255	9.7398696	10.2601304	13
48	9.6828250	9.9426561	9.7401689	10.2598311	12
49	9.6830548	9.9425866	9.7404681	10.2595319	11
50	9.6832843	9.9425171	9.7407672	10.2592328	10
51	9.6835137	9.9424476	9.7410662	10.2589338	9
52	9.6837430	9.9423779	9.7413650	10.2586350	8
53	9.6839720	9.9423083	9.7416638	10.2583362	7
54	9.6842010	9.9422386	9.7419624	10.2580376	6
55	9.6844297	9.9421688	9.7422609	10.2577391	5
56	9.6846583	9.9420990	9.7425594	10.2574406	4
57	9.6848868	9.9420291	9.7428577	10.2571423	3
58	9.6851151	9.9419592	9.7431559	10.2568441	2
59	9.6854432	9.9418893	9.7434540	10.2565460	1
60	9.6855712	9.9418193	9.7437520	10.2562480	0
	Sine Comp.	Sine	Tang. Com·	Tang.	Min.
	61 Degrees				

Min.	29 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.6855712	9.9418193	9.7437520	10.2562480	60
1	9.6857991	9.9417492	9.7440499	10.2559501	59
2	9.6860267	9.9416791	9.7443476	10.2556524	58
3	9.6862542	9.9416090	9.7446453	10.2553547	57
4	9.6864816	9.9415388	9.7449428	10.2550572	56
5	9.6867088	9.9414685	9.7452403	10.2547597	55
6	9.6869359	9.9413982	9.7455376	10.2544624	54
7	9.6871628	9.9413279	9.7458349	10.2541651	53
8	9.6873895	9.9412575	9.7461320	10.2538680	52
9	9.6876161	9.9411871	9.7464290	10.2535710	51
10	9.6878425	9.9411166	9.7467259	10.2532741	50
11	9.6880688	9.9410461	9.7470227	10.2529773	49
12	9.6882949	9.9409755	9.7473194	10.2526806	48
13	9.6885209	9.9409048	9.7476160	10.2523840	47
14	9.6887467	9.9408342	9.7479125	10.2520875	46
15	9.6889723	9.9407634	9.7482089	10.2517911	45
16	9.6891978	9.9406927	9.7485052	10.2514948	44
17	9.6894232	9.9406219	9.7488013	10.2511987	43
18	9.6896484	9.9405510	9.7490974	10.2509026	42
19	9.6898734	9.9404801	9.7493934	10.2506066	41
20	9.6900983	9.9404091	9.7496892	10.2503108	40
21	9.6903231	9.9403381	9.7499850	10.2500150	39
22	9.6905476	9.9402670	9.7502806	10.2497194	38
23	9.6907721	9.9401959	9.7505762	10.2494238	37
24	9.6909964	9.9401248	9.7508716	10.2491284	36
25	9.6912205	9.9400535	9.7511669	10.2488331	35
26	9.6914445	9.9399823	9.7514622	10.2485378	34
27	9.6916683	9.9399110	9.7517573	10.2482427	33
28	9.6918919	9.9398396	9.7520523	10.2479477	32
29	9.6921155	9.9397682	9.7523472	10.2476526	31
30	9.6923388	9.9396968	9.7526420	10.2473580	30
31	9.6925620	9.9396253	9.7529368	10.2470632	29
32	9.6927851	9.9395537	9.7532314	10.2467686	28
33	9.6930080	9.9394821	9.7535259	10.2464741	27
34	9.6932308	9.9394105	9.7538203	10.2461797	26
35	9.6934534	9.9393388	9.7541146	10.2458854	25
36	9.6936758	9.9392671	9.7544088	10.2455912	24
37	9.6938981	9.9391953	9.7547029	10.2452971	23
38	9.6941203	9.9391234	9.7549969	10.2450031	22
39	9.6943423	9.9390515	9.7552908	10.2447092	21
40	9.6945642	9.9389796	9.7555846	10.2444154	20
41	9.6947859	9.9389076	9.7558783	10.2441217	19
42	9.6950074	9.9388356	9.7561718	10.2438282	18
43	9.6952288	9.9387635	9.7564653	10.2435347	17
44	9.6954501	9.9386914	9.7567587	10.2432413	16
45	9.6956712	9.9386192	9.7570520	10.2429480	15
46	9.6958922	9.9385470	9.7573452	10.2426548	14
47	9.6961130	9.9384747	9.7576383	10.2423617	13
48	9.6963336	9.9384024	9.7579313	10.2420687	12
49	9.6965541	9.9383300	9.7582242	10.2417758	11
50	9.6967745	9.9382576	9.7585170	10.2414830	10
51	9.6969947	9.9381851	9.7588096	10.2411904	9
52	9.6972148	9.9381126	9.7591022	10.2408978	8
53	9.6974347	9.9380400	9.7593947	10.2406053	7
54	9.6976545	9.9379674	9.7596871	10.2403129	6
55	9.6978741	9.9378947	9.7599794	10.2400206	5
56	9.6980936	9.9378220	9.7602716	10.2397284	4
57	9.6983129	9.9377492	9.7605637	10.2394363	3
58	9.6985321	9.9376764	9.7608557	10.2391443	2
59	9.6987511	9.9376035	9.7611476	10.2388524	1
60	9.6989700	9.9375306	9.7614394	10.2385606	0
	Sine Comp.	Sine	Tang. C·m	Tang.	Min.
	60 Degrees				

Min.	30 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.6989700	9.9375306	9.7614394	10.2385606	60
1	9.6991887	9.9374577	9.7617311	10.2382689	59
2	9.6994073	9.9373847	9.7620227	10.2379773	58
3	9.6996258	9.9376116	9.7623142	10.2376858	57
4	9.6998441	9.9372385	9.7626056	10.2373944	56
5	9.7000622	9.9371653	9.7628969	10.2371031	55
6	9.7002802	9.9370921	9.7631881	10.2368119	54
7	9.7004981	9.9370189	9.7634792	10.2365208	53
8	9.7007158	9.9369456	9.7637702	10.2362298	52
9	9.7009334	9.9368722	9.7640612	10.2359388	51
10	9.7011508	9.9367988	9.7643520	10.2356480	50
11	9.7013681	9.9367254	9.7646427	10.2353573	49
12	9.7015852	9.9366519	9.7649334	10.2350666	48
13	9.7018022	9.9365783	9.4652239	10.2347761	47
14	9.7020190	9.9365047	9.7655143	10.2344857	46
15	9.7022357	9.9364311	9.7658047	10.2341953	45
16	9.7024523	9.9363574	9.7660949	10.2339051	44
17	9.7026687	9.9362836	9.7663851	10.2336149	43
18	9.7028849	9.9362298	9.7666751	10.2333249	42
19	9.7031011	9.9361360	9.7669651	10.2330349	41
20	9.7033170	9.9360621	9.7672550	10.2327450	40
21	9.7035329	9.9359881	9.7675448	10.2324552	39
22	9.7037486	9.9359141	9.7678344	10.2321656	38
23	9.7039641	9.9358401	9.7681240	10.2318760	37
24	9.7041795	9.9357660	9.7684135	10.2315865	36
25	9.7043947	9.9356918	9.7687029	10.2312971	35
26	9.7046099	9.9356177	9.7689922	10.2310078	34
27	9.7048248	9.9355434	9.7692814	10.2307186	33
28	9.7050397	9.9354691	9.7695705	10.2304295	32
29	9.7052543	9.9353948	9.7698596	10.2301404	31
30	9.7054689	9.9353204	9.7701485	10.2298515	30
31	9.7056833	9.9352459	9.7704373	10.2295627	29
32	9.7058975	9.9351715	9.7707261	10.2292739	28
33	9.7061116	9.9350969	9.7710147	10.2289853	27
34	9.7063256	9.9350223	9.7713033	10.2286967	26
35	9.7065394	9.9349477	9.7715917	10.2284083	25
36	9.7067531	9.9348730	9.7718801	10.2281199	24
37	9.7069667	9.9347983	9.7721684	10.2278316	23
38	9.7071801	9.9347235	9.7724566	10.2275434	22
39	9.7073933	9.9346486	9.7727447	10.2272553	21
40	9.7076064	9.9345738	9.7730327	10.2269673	20
41	9.7078194	9.9344988	9.7733206	10.2266794	19
42	9.7080323	9.9344238	9.7736084	10.2263916	18
43	9.7082450	9.9343488	9.7738961	10.2261039	17
44	9.7084575	9.9342737	9.7741838	10.2258162	16
45	9.7086699	9.9341986	9.7744713	10.2255287	15
46	9.7088822	9.9341234	9.7747588	10.2252412	14
47	9.7090943	9.9340482	9.7750462	10.2249538	13
48	9.7093063	9.9339729	9.7753334	10.2246666	12
49	9.7095182	9.9338976	9.7756206	10.2243794	11
50	9.7097299	9.9338222	9.7759077	10.2240923	10
51	9.7099415	9.9337467	9.7761947	10.2238053	9
52	9.7101529	9.9336713	9.7764816	10.2235184	8
53	9.7103642	9.9335957	9.7767685	10.2232315	7
54	9.7105753	9.9335201	9.7770552	10.2229448	6
55	9.7107863	9.9334445	9.7773418	10.2226582	5
56	9.7109972	9.9333688	9.7776284	10.2223716	4
57	9.7112080	9.9332931	9.7779149	10.2220851	3
58	9.7114186	9.9332173	9.7782012	10.2217988	2
59	9.7116290	9.9331415	9.7784875	10.2215125	1
60	9.7118393	9.9330656	9.7787737	10.2212263	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	59 Degrees				

Min.	31 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7118393	9.9330656	9.7787737	10.2212263	60
1	9.7120495	9.9329897	9.7790599	10.2209401	59
2	9.7122596	9.9329137	9.7793459	10.2206541	58
3	9.7124695	9.9328376	9.7796318	10.2203682	57
4	9.7126792	9.9327616	9.7799177	10.2200823	56
5	9.7128889	9.9326854	9.7802034	10.2197966	55
6	9.7130983	9.9326092	9.7804891	10.2195109	54
7	9.7133077	9.9325330	9.7807747	10.2192253	53
8	9.7135169	9.9324567	9.7810602	10.2189398	52
9	9.7137260	9.9323804	9.7813456	10.2186544	51
10	9.7139349	9.9323040	9.7816309	10.2183691	50
11	9.7141437	9.9322276	9.7819162	10.2180838	49
12	9.7143524	9.9321511	9.7822013	10.2177987	48
13	9.7145609	9.9320746	9.7824864	10.2175136	47
14	9.7147693	9.9319980	9.7827713	10.2172287	46
15	9.7149776	9.9319213	9.7830562	10.2169438	45
16	9.7151857	9.9318447	9.7833410	10.2166590	44
17	9.7153937	9.9317679	9.7836258	10.2163742	43
18	9.7156015	9.9316911	9.7839104	10.2160896	42
19	9.7158092	9.9316143	9.7841949	10.2158051	41
20	9.7160168	9.9315374	9.7844794	10.2155206	40
21	9.7162243	9.9314605	9.7847638	10.2152362	39
22	9.7164316	9.9313835	9.7850481	10.2149519	38
23	9.7166387	9.9313065	9.7853323	10.2146677	37
24	9.7168458	9.9312294	9.7856164	10.2143836	36
25	9.7170526	9.9311522	9.7859004	10.2140996	35
26	9.7172594	9.9310750	9.7861844	10.2138156	34
27	9.7174660	9.9309978	9.7864682	10.2135318	33
28	9.7176725	9.9309205	9.7867520	10.2132480	32
29	9.7178789	9.9308432	9.7870357	10.2129643	31
30	9.7180851	9.9307658	9.7873193	10.2126807	30
31	9.7182912	9.9306883	9.7876028	10.2123972	29
32	9.7184971	9.9306109	9.7878863	10.2121137	28
33	9.7187030	9.9305333	9.7881696	10.2118304	27
34	9.7189086	9.9304557	9.7884529	10.2115471	26
35	9.7191142	9.9303781	9.7887361	10.2112639	25
36	9.7193196	9.9303004	9.7890192	10.2109808	24
37	9.7195249	9.9302226	9.7893023	10.2106977	23
38	9.7197300	9.9301448	9.7895852	10.2104148	22
39	9.7199350	9.9300670	9.7898681	10.2101319	21
40	9.7201399	9.9299891	9.7901508	10.2098492	20
41	9.7203447	9.9299112	9.7904335	10.2095665	19
42	9.7205493	9.9298332	9.7907161	10.2092839	18
43	9.7207538	9.9297551	9.7909987	10.2090013	17
44	9.7209581	9.9296770	9.7912811	10.2087189	16
45	9.7211623	9.9295989	9.7915635	10.2084365	15
46	9.7213664	9.9295207	9.7918458	10.2081542	14
47	9.7215704	9.9294424	9.7921280	10.2078720	13
48	9.7217742	9.9293641	9.7924101	10.2075899	12
49	9.7219779	9.9292857	9.7926921	10.2073079	11
50	9.7221814	9.9292073	9.7929741	10.2070259	10
51	9.7223848	9.9291289	9.7932560	10.2067440	9
52	9.7225881	9.9290504	9.7935378	10.2064622	8
53	9.7227913	9.9289718	9.7938195	10.2061805	7
54	9.7229943	9.9288932	9.7941011	10.2058989	6
55	9.7231972	9.9288145	9.7943827	10.2056173	5
56	9.7234000	9.9287358	9.7946641	10.2053359	4
57	9.7236026	9.9286571	9.7949455	10.2050545	3
58	9.7238051	9.9285783	9.7952268	10.2047732	2
59	9.7240075	9.9284994	9.7955081	10.2044919	1
60	9.7242097	9.9284205	9.7957892	10.2042108	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	58 Degrees				

32 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.7242097	9.9284205	9.7957892	10.2042108	60
1	9.7244118	9.9283415	9.7960703	10.2039297	59
2	9.7246138	9.9282625	9.7963513	10.2036487	58
3	9.7248156	9.9281834	9.7966322	10.2033678	57
4	9.7250174	9.9281043	9.7969130	10.2030870	56
5	9.7252189	9.9280251	9.7971938	10.2028062	55
6	9.7254204	9.9279459	9.7974745	10.2025255	54
7	9.7256217	9.9278666	9.7977551	10.2022449	53
8	9.7258229	9.9277873	9.7980356	10.2019644	52
9	9.7260240	9.9277079	9.7983160	10.2016840	51
10	9.7262249	9.9276285	9.7985964	10.2014036	50
11	9.7264257	9.9275490	9.7988767	10.2011233	49
12	9.7266264	9.9274695	9.7991569	10.2008431	48
13	9.7268269	9.9273899	9.7994370	10.2005630	47
14	9.7270273	9.9273103	9.7997170	10.2002830	46
15	9.7272276	9.9272306	9.7999970	10.2000030	45
16	9.7274278	9.9271509	9.8002769	10.1997231	44
17	9.7276278	9.9270711	9.8005567	10.1994433	43
18	9.7278277	9.9269913	9.8008365	10.1991635	42
19	9.7280275	9.9269114	9.8011161	10.1988839	41
20	9.7282271	9.9268314	9.8013957	10.1986043	40
21	9.7284267	9.9267514	9.8016752	10.1983248	39
22	9.7286260	9.9266714	9.8019546	10.1980454	38
23	9.7288253	9.9265913	9.8022340	10.1977660	37
24	9.7290244	9.9265112	9.8025133	10.1974867	36
25	9.7292234	9.9264310	9.8027925	10.1972075	35
26	9.7294223	9.9263507	9.8030716	10.1969284	34
27	9.7296211	9.9262704	9.8033506	10.1966494	33
28	9.7298197	9.9261901	9.8036296	10.1963704	32
29	9.7300182	9.9261096	9.8039085	10.1960915	31
30	9.7302165	9.9260292	9.8041873	10.1958127	30
31	9.7304148	9.9259487	9.8044661	10.1955339	29
32	9.7306129	9.9258681	9.8047447	10.1952553	28
33	9.7308109	9.9257875	9.8050233	10.1949767	27
34	9.7310087	9.9257069	9.8053019	10.1946981	26
35	9.7312064	9.9256261	9.8055803	10.1944197	25
36	9.7314040	9.9255454	9.8058587	10.1941413	24
37	9.7316015	9.9254646	9.8061370	10.1938630	23
38	9.7317989	9.9253837	9.8064152	10.1935848	22
39	9.7319961	9.9253028	9.8066933	10.1933067	21
40	9.7321932	9.9252218	9.8069714	10.1930286	20
41	9.7323902	9.9251408	9.8072494	10.1927506	19
42	9.7325870	9.9250597	9.8075273	10.1924727	18
43	9.7327837	9.9249786	9.8078052	10.1921948	17
44	9.7329803	9.9248974	9.8080829	10.1919171	16
45	9.7331768	9.9248161	9.8083606	10.1916394	15
46	9.7333731	9.9247349	9.8086383	10.1913617	14
47	9.7335693	9.9246535	9.8089158	10.1910842	13
48	9.7337654	9.9245721	9.8091933	10.1908067	12
49	9.7339614	9.9244907	9.8094707	10.1905293	11
50	9.7341572	9.9244092	9.8097480	10.1902520	10
51	9.7343529	9.9243277	9.8100253	10.1899747	9
52	9.7345485	9.9242461	9.8103025	10.1896975	8
53	9.7347440	9.9241644	9.8105796	10.1894204	7
54	9.7349393	9.9240827	9.8108566	10.1891434	6
55	9.7351345	9.9240010	9.8111336	10.1888664	5
56	9.7353296	9.9239191	9.8114105	10.1885895	4
57	9.7355246	9.9238373	9.8116873	10.1883127	3
58	9.7357195	9.9237554	9.8119641	10.1880359	2
59	9.7359142	9.9236734	9.8122408	10.1877592	1
60	9.7361088	9.9235914	9.8125174	10.1874826	0
	Sine Comp	Sine	Tang. Com.	Tang.	Min.

57 Degrees

33 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.7361088	9.9235914	9.8125174	10.1874826	60
1	9.7363032	9.9235093	9.8127939	10.1872061	59
2	9.7364976	9.9234272	9.8130704	10.1869296	58
3	9.7366918	9.9233450	9.8133468	10.1866532	57
4	9.7368859	9.9232628	9.8136231	10.1863769	56
5	9.7370799	9.9231805	9.8138993	10.1861007	55
6	9.7372737	9.9230982	9.8141755	10.1858245	54
7	9.7374675	9.9230158	9.8144516	10.1855484	53
8	9.7376611	9.9229334	9.8147277	10.1852723	52
9	9.7378546	9.9228509	9.8150036	10.1849964	51
10	9.7380479	9.9227684	9.8152795	10.1847205	50
11	9.7382412	9.9226858	9.8155554	10.1844446	49
12	9.7384343	9.9226032	9.8158311	10.1841689	48
13	9.7386273	9.9225205	9.8161068	10.1838932	47
14	9.7388201	9.9224377	9.8163824	10.1836176	46
15	9.7390129	9.9223549	9.8166580	10.1833420	45
16	9.7392055	9.9222721	9.8169335	10.1830665	44
17	9.7393980	9.9221891	9.8172089	10.1827911	43
18	9.7395904	9.9221062	9.8174842	10.1825158	42
19	9.7397827	9.9220232	9.8177595	10.1822405	41
20	9.7399748	9.9219401	9.8180347	10.1819653	40
21	9.7401668	9.9218570	9.8183098	10.1816902	39
22	9.7403587	9.9217738	9.8185849	10.1814151	38
23	9.7405505	9.9216906	9.8188599	10.1811401	37
24	9.7407421	9.9216073	9.8191348	10.1808652	36
25	9.7409337	9.9215240	9.8194096	10.1805904	35
26	9.7411251	9.9214406	9.8196844	10.1803156	34
27	9.7413164	9.9213572	9.8199592	10.1800408	33
28	9.7415075	9.9212737	9.8202338	10.1797662	32
29	9.7416986	9.9211902	9.8205084	10.1794916	31
30	9.7418895	9.9211066	9.8207829	10.1792171	30
31	9.7420803	9.9210229	9.8210574	10.1789426	29
32	9.7422710	9.9209393	9.8213317	10.1786683	28
33	9.7424616	9.9208555	9.8216060	10.1783940	27
34	9.7426520	9.9207717	9.8218803	10.1781197	26
35	9.7428423	9.9206878	9.8221545	10.1778455	25
36	9.7430325	9.9206039	9.8224286	10.1775714	24
37	9.7432226	9.9205200	9.8227026	10.1772974	23
38	9.7434126	9.9204360	9.8229766	10.1770234	22
39	9.7436024	9.9203519	9.8232505	10.1767495	21
40	9.7437921	9.9202678	9.8235244	10.1764756	20
41	9.7439817	9.9201836	9.8237981	10.1762019	19
42	9.7441712	9.9200994	9.8240719	10.1759281	18
43	9.7443606	9.9200151	9.8243455	10.1756545	17
44	9.7445498	9.9199308	9.8246191	10.1753809	16
45	9.7447390	9.9198464	9.8248926	10.1751074	15
46	9.7449280	9.9197619	9.8251660	10.1748340	14
47	9.7451169	9.9196775	9.8254394	10.1745606	13
48	9.7453056	9.9195929	9.8257127	10.1742873	12
49	9.7454943	9.9195083	9.8259860	10.1740140	11
50	9.7456828	9.9194237	9.8262592	10.1737408	10
51	9.7458712	9.9193390	9.8265323	10.1734677	9
52	9.7460595	9.9192542	9.8268053	10.1731947	8
53	9.7462477	9.9191694	9.8270783	10.1729217	7
54	9.7464358	9.9190845	9.8273513	10.1726487	6
55	9.7466237	9.9189996	9.8276241	10.1723759	5
56	9.7468115	9.9189146	9.8278969	10.1721031	4
57	9.7469992	9.9188296	9.8281696	10.1718304	3
58	9.7471868	9.9187445	9.8284423	10.1715577	2
59	9.7473743	9.9186594	9.8287149	10.1712851	1
60	9.7475617	9.9185742	9.8289874	10.1710126	0
	Sine Comp	Sine	Tang. Com	Tang.	Min.

56 Degrees

Min.	34 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7475617	9.9185742	9.8289874	10.1710126	60
1	9.7477489	9.9184890	9.8292599	10.1707401	59
2	9.7479360	9.9184037	9.8295323	10.1704677	58
3	9.7481230	9.9183183	9.8298047	10.1701953	57
4	9.7483099	9.9182329	9.8300769	10.1699231	56
5	9.7484967	9.9181475	9.8303492	10.1696508	55
6	9.7486833	9.9180620	9.8306213	10.1693787	54
7	9.7488698	9.9179764	9.8308934	10.1691066	53
8	9.7490562	9.9178908	9.8311654	10.1688346	52
9	9.7492425	9.9178051	9.8314374	10.1685626	51
10	9.7494287	9.9177194	9.8317093	10.1682907	50
11	9.7496148	9.9176336	9.8319811	10.1680189	49
12	9.7498007	9.9175478	9.8322529	10.1677471	48
13	9.7499866	9.9174619	9.8325246	10.1674754	47
14	9.7501723	9.9173760	9.8327963	10.1672037	46
15	9.7503579	9.9172900	9.8330679	10.1669321	45
16	9.7505434	9.9172040	9.8333394	10.1666600	44
17	9.7507287	9.9171179	9.8336109	10.1663891	43
18	9.7509140	9.9170317	9.8338823	10.1661177	42
19	9.7510991	9.9169455	9.8341536	10.1658464	41
20	9.7512842	9.9168593	9.8344249	10.1655751	40
21	9.7514691	9.9167730	9.8346961	10.1653039	39
22	9.7516538	9.9166866	9.8349673	10.1650327	38
23	9.7518385	9.9166002	9.8352384	10.1647616	37
24	9.7520231	9.9165137	9.8355094	10.1644906	36
25	9.7522075	9.9164272	9.8357804	10.1642196	35
26	9.7523919	9.9163406	9.8360513	10.1639487	34
27	9.7525761	9.9162539	9.8363221	10.1636779	33
28	9.7527602	9.9161673	9.8365929	10.1634071	32
29	9.7529442	9.9160805	9.8368636	10.1631364	31
30	9.7531280	9.9159937	9.8371343	10.1628657	30
31	9.7533118	9.9159069	9.8374049	10.1625951	29
32	9.7534954	9.9158200	9.8376755	10.1623245	28
33	9.7536790	9.9157330	9.8379460	10.1620540	27
34	9.7538624	9.9156460	9.8382164	10.1617836	26
35	9.7540457	9.9155589	9.8384867	10.1615133	25
36	9.7542288	9.9154718	9.8387571	10.1612429	24
37	9.7544119	9.9153846	9.8390273	10.1609727	23
38	9.7545949	9.9152974	9.8392975	10.1607025	22
39	9.7547777	9.9152101	9.8395676	10.1604324	21
40	9.7549604	9.9151228	9.8398377	10.1601623	20
41	9.7551431	9.9150354	9.8401077	10.1598923	19
42	9.7553256	9.9149749	9.8403776	10.1596224	18
43	9.7555080	9.9148604	9.8406475	10.1593525	17
44	9.7556902	9.9147729	9.8409174	10.1590826	16
45	9.7558724	9.9146852	9.8411871	10.1588129	15
46	9.7560544	9.9145976	9.8414569	10.1585431	14
47	9.7562364	9.9145099	9.8417265	10.1582735	13
48	9.7564182	9.9144221	9.8419961	10.1580039	12
49	9.7565999	9.9143342	9.8422657	10.1577343	11
50	9.7567815	9.9142464	9.8425351	10.1574649	10
51	9.7569630	9.9141584	9.8428046	10.1571954	9
52	9.7571444	9.9140704	9.8430739	10.1569261	8
53	9.7573256	9.9139824	9.8433432	10.1566568	7
54	9.7575068	9.9138943	9.8436125	10.1563875	6
55	9.7576878	9.9138061	9.8438817	10.1561183	5
56	9.7578687	9.9137179	9.8441508	10.1558492	4
57	9.7580495	9.9136296	9.8444199	10.1555801	3
58	9.7582302	9.9135413	9.8446889	10.1553111	2
59	9.7584108	9.9134530	9.8449579	10.1550421	1
60	9.7585913	9.9133645	9.8452268	10.1547732	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	55 Degrees				

Min.	35 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7585913	9.9133645	9.8452268	10.1547732	60
1	9.7587717	9.9132760	9.8454956	10.1545044	59
2	9.7589519	9.9131875	9.8457644	10.1542356	58
3	9.7591321	9.9130989	9.8460332	10.1539668	57
4	9.7593121	9.9130102	9.8463018	10.1536982	56
5	9.7594920	9.9129215	9.8465705	10.1534295	55
6	9.7596718	9.9128328	9.8468390	10.1531610	54
7	9.7598515	9.9127440	9.8471075	10.1538925	53
8	9.7600311	9.9126551	9.8473760	10.1526240	52
9	9.7602106	9.9125662	9.8476444	10.1523556	51
10	9.7603899	9.9124772	9.8479127	10.1520873	50
11	9.7605692	9.9123882	9.8481810	10.1518190	49
12	9.7607483	9.9122991	9.8484492	10.1515508	48
13	9.7609274	9.9122099	9.8487174	10.1512826	47
14	9.7611063	9.9121207	9.8489855	10.1510145	46
15	9.7612851	9.9120315	9.8492536	10.1507464	45
16	9.7614638	9.9119422	9.8495216	10.1504784	44
17	9.7616424	9.9118528	9.8497896	10.1502104	43
18	9.7618208	9.9117634	9.8500575	10.1499425	42
19	9.7619992	9.9116739	9.8503253	10.1496747	41
20	9.7621775	9.9115844	9.8505931	10.1494069	40
21	9.7623556	9.9114948	9.8508608	10.1491392	39
22	9.7625337	9.9114051	9.8511285	10.1488715	38
23	9.7627116	9.9113155	9.8513961	10.1486039	37
24	9.7628894	9.9112257	9.8516637	10.1483363	36
25	9.7630671	9.9111359	9.8519312	10.1480688	35
26	9.7632447	9.9110460	9.8521987	10.1478013	34
27	9.7634222	9.9109561	9.8524661	10.1475339	33
28	9.7635996	9.9108661	9.8527335	10.1472665	32
29	9.7637769	9.9107761	9.8530008	10.1469992	31
30	9.7639540	9.9106860	9.8532680	10.1467320	30
31	9.7641311	9.9105959	9.8535352	10.1464648	29
32	9.7643080	9.9105057	9.8538023	10.1461977	28
33	9.7644849	9.9104155	9.8540694	10.1459306	27
34	9.7646616	9.9103251	9.8543365	10.1456635	26
35	9.7648382	9.9102348	9.8546034	10.1453966	25
36	9.7650147	9.9101444	9.8548704	10.1451296	24
37	9.7651911	9.9100539	9.8551372	10.1448628	23
38	9.7653674	9.9099634	9.8554041	10.1445959	22
39	9.7655436	9.9098728	9.8556708	10.1443292	21
40	9.7657197	9.9097821	9.8559376	10.1440624	20
41	9.7658957	9.9096915	9.8562042	10.1437958	19
42	9.7660715	9.9096007	9.8564708	10.1435292	18
43	9.7662473	9.9095099	9.8567374	10.1432626	17
44	9.7664229	9.9094190	9.8570039	10.1429961	16
45	9.7665985	9.9093281	9.8572704	10.1427296	15
46	9.7667739	9.9092371	9.8575368	10.1424632	14
47	9.7669492	9.9091461	9.8578031	10.1421969	13
48	9.7671244	9.9090550	9.8580694	10.1419306	12
49	9.7672996	9.9089639	9.8583357	10.1416643	11
50	9.7674746	9.9088727	9.8586019	10.1413981	10
51	9.7676494	9.9087814	9.8588680	10.1411320	9
52	9.7678242	9.9086901	9.8591341	10.1408659	8
53	9.7679989	9.9085988	9.8594002	10.1405998	7
54	9.7681735	9.9085073	9.8596661	10.1403339	6
55	9.7683480	9.9084159	9.8599321	10.1400679	5
56	9.7685223	9.9083243	9.8601980	10.1398020	4
57	9.7686966	9.9082327	9.8604638	10.1395362	3
58	9.7688707	9.9081411	9.8607296	10.1392704	2
59	9.7690448	9.9080494	9.8609954	10.1390046	1
60	9.7692187	9.9079576	9.8612610	10.1387390	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	54 Degrees				

36 Degrees

Min.	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7692187	9.9079576	9.8612610	10.1387390	60
1	9.7693925	9.9078658	9.8615267	10.1384733	59
2	9.7695662	9 9077740	9.8617923	10.1382077	58
3	9.7697398	9.9076820	9.8620578	10.1379422	57
4	9.7699134	9.9075901	9.8623233	10.1376767	56
5	9.7700868	9.9074980	9.8625887	10.1374113	55
6	9.7702601	9.9074059	9.8628541	10.1371459	54
7	9.7704332	9.9073138	9.8631195	10.1368805	53
8	9.7706063	9.9072216	9.8633848	10.1366152	52
9	9.7707793	9.9071293	9.8636500	10.1363500	51
10	9.7709522	9.9070370	9.8639152	10.1360848	50
11	9.7711249	9.9069446	9.8641803	10.1358197	49
12	9.7712976	9.9068522	9.8644454	10.1355546	48
13	9.7714702	9.9067597	9.8647105	10.1352895	47
14	9.7716426	9.9066671	9.8649755	10.1350245	46
15	9.7718150	9.9065745	9.8652404	10.1347596	45
16	9.7719872	9.9064819	9.8655053	10.1344947	44
17	9.7721593	9.9063892	9.8657702	10.1342298	43
18	9.7723314	9.9062964	9.8660350	10.1339650	42
19	9.7725033	9.9062036	9.8662997	10.1337003	41
20	9.7726751	9.9061107	9.8665644	10.1334356	40
21	9.7728468	9.9060177	9.8668291	10.1331709	39
22	9.7730185	9.9059247	9.8670937	10.1329063	38
23	9.7731900	9.9058317	9.8673583	10.1326417	37
24	9.7733614	9.9057386	9.8676228	10.1323772	36
25	9.7735327	9.9056454	9.8678873	10.1321127	35
26	9.7737039	9.9055522	9.8681517	10.1318483	34
27	9.7738749	9.9054589	9.8684160	10.1315840	33
28	9.7740459	9.9053656	9.8686804	10.1313196	32
29	9 7742168	9.9052722	9.8689446	10.1310554	31
30	9.7743876	9.9051787	9.8692089	10.1307911	30
31	9.7745583	9.9050852	9.8694731	10.1305269	29
32	9.7747288	9.9049916	9.8697372	10.1302628	28
33	9.7748993	9.9048980	9 8700013	10.1299987	27
34	9.7750697	9.9048043	9.8702653	10.1297347	26
35	9.7752399	9.9047106	9.8705293	10.1294707	25
36	9.7754101	9.9046168	9.8707933	10.1292067	24
37	9.7755801	9.9045230	9.8710572	10.1289428	23
38	9.7757501	9.9044291	9.8713210	10.1286790	22
39	9.7759199	9 9043351	9.8715848	10.1284152	21
40	9.7760897	9.9042411	9.8718486	10.1281514	20
41	9.7762593	9.9041470	9.8721123	10.1278877	19
42	9.7764289	9.9040529	9.8723760	10.1276240	18
43	9.7765983	9 9039587	9.8726396	10.1273604	17
44	9.7767676	9.9038644	9.8729032	10.1270968	16
45	9.7769369	9.9037701	9.8731668	10.1268332	15
46	9.7771060	9.9036757	9.8734302	10.1265698	14
47	9.7772750	9 9035813	9.8736937	10.1263063	13
48	9.7774439	9.9034868	9.8739571	10.1260429	12
49	9.7776128	9.9033923	9.8742204	10.1257796	11
50	9.7777815	9.9032977	9.8744838	10.1255162	10
51	9.7779501	9.9032031	9.8747470	10.1252530	9
52	9.7781186	9.9031084	9.8750102	10.1249898	8
53	9.7782870	9.9030136	9.8752734	10.1247266	7
54	9.7784553	9.9029188	9.8755365	10.1244635	6
55	9.7786235	9.9028239	9.3757996	10.1242004	5
56	9.7787916	9.9027289	9.8760627	10.1239373	4
57	9.7789596	9.9026339	9.8763257	10.1236743	3
58	9.7791275	9.9025389	9.8765886	10.1234114	2
59	9.7792953	9.9024438	9.8768515	10.1231485	1
60	9 7794630	9.9023486	9.8771144	10.1228856	0
	Sine Comp.	Sine	Tang. Com	Tang.	Min.

53 Degrees

37 Degrees

Min.	Sine	Sine Comp.	Tang	Tang. Comp.	
0	9.7794630	9.9023486	9.8771144	10.1228856	60
1	9.7796306	9.9022534	9.8773772	10.1226228	59
2	9.7797981	9.9021581	9.8776400	10.1223600	58
3	9.7799655	9.9020628	9.8779027	10.1220973	57
4	9.7801328	9.9019674	9.8781654	10.1218346	56
5	9.7803000	9.9018719	9.8784281	10.1215719	55
6	9.7804671	9.9017764	9.8786907	10.1213093	54
7	9.7806341	9.9016808	9.8789533	10.1210467	53
8	9.7808010	9.9015852	9.8792158	10.1207842	52
9	9.7809677	9.9014895	9.8794782	10.1205218	51
10	9.7811344	9.9013938	9.8797407	10.1202593	50
11	9.7813010	9.9012980	9.8800031	10.1199969	49
12	9.7814675	9.9012021	9.8802654	10.1197346	48
13	9.7816339	9.9011062	9.8805277	10.1194723	47
14	9.7818002	9.9010102	9.8807900	10.1192100	46
15	9.7819664	9.9009142	9.8810522	10.1189478	45
16	9.7821324	9.9008181	9.8813144	10.1186856	44
17	9.7822984	9.9007219	9.8815765	10.1184235	43
18	9.7824643	9.9006257	9.8818386	10.1181614	42
19	9.7826301	9.9005294	9.8821007	10.1178993	41
20	9.7827958	9.9004331	9.8823627	10.1176373	40
21	9.7829614	9.9003367	9.8826246	10.1173754	39
22	9.7831268	9.9002403	9.8828866	10.1171134	38
23	9.7832922	9.9001438	9.8831484	10 1168516	37
24	9.7834575	9.9000472	9.8834103	10.1165897	36
25	9.7836227	9.8999506	9.8836721	10.1163279	35
26	9.7837878	9.8998539	9.8839338	10.1160662	34
27	9.7839528	9.8997572	9.8841956	10.1158044	33
28	9.7841177	9.8996604	9.8844572	10.1155428	32
29	9.7842824	9.8995636	9.8847189	10.1152811	31
30	9.7844471	9.8994667	9.8849805	10.1150195	30
31	9.7846117	9.8993697	9.8852420	10.1147580	29
32	9.7847762	9.8992727	9.8855035	10.1144965	28
33	9.7849406	9.8991756	9.8857650	10.1142350	27
34	9.7851049	9.8990784	9.8860264	10.1139736	26
35	9.7852691	9.8989812	9.8862878	10.1137122	25
36	9.7854332	9.8988840	9.8865492	10.1134508	24
37	9.7855972	9.8987867	9.8868105	10.1131895	23
38	9.7857611	9.8986893	9.8870718	10.1129282	22
39	9.7859249	9.8985919	9.8873330	10.1126670	21
40	9.7860886	9.8984944	9.8875942	10.1124058	20
41	9.7862522	9.8983968	9.8878554	10.1121446	19
42	9.7864157	9.8982992	9.8881165	10.1118835	18
43	9.7865791	9.8982015	9.8883775	10.1116225	17
44	9.7867424	9.8981038	9.8886386	10.1113614	16
45	9.7869056	9.8980060	9.8888996	10.1111004	15
46	9.7870687	9.8979082	9.8891605	10.1108395	14
47	9.7872317	9.8978103	9.8894214	10.1105786	13
48	9.7873946	9.8977123	9.8896823	10.1103177	12
49	9.7875574	9.8976143	9.8899432	10.1100568	11
50	9.7877202	9.8975162	9.8902040	10.1097960	10
51	9.7878828	9.8974181	9.8904647	10.1095353	9
52	9.7880453	9.8973199	9.8907254	10.1092746	8
53	9.7882077	9.8972216	9.8909861	10.1090139	7
54	9.7883701	9.8971233	9.8912468	10.1087532	6
55	9.7885323	9.8970249	9.8915074	10.1084926	5
56	9.7886944	9.8969265	9.8917679	10.1082321	4
57	9.7888565	9.8968280	9.8920285	10.1079715	3
58	9.7890184	9.8967294	9.8922890	10.1077110	2
59	9.7891802	9.8966308	9.8925494	10.1074506	1
60	9.7893420	9.8965321	9 8928098	10.1071902	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.

52 Degrees

Min.	38 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7893420	9.8965321	9.8928098	10.1071902	60
1	9.7895036	9.8964334	9.8930702	10.1069298	59
2	9.7896652	9.8963346	9.8933306	10.1066694	58
3	9.7898266	9.8962358	9.8935909	10.1064091	57
4	9.7899880	9.8961369	9.8938511	10.1061489	56
5	9.7901493	9.8960379	9.8941114	10.1058886	55
6	9.7903104	9.8959389	9.8943715	10.1056285	54
7	9.7904715	9.8958398	9.8946317	10.1053683	53
8	9.7906325	9.8957406	9.8948918	10.1051082	52
9	9.7907933	9.8956414	9.8951519	10.1048481	51
10	9.7909541	9.8955422	9.8954119	10.1045881	50
11	9.7911148	9.8954429	9.8956719	10.1043281	49
12	9.7912754	9.8953435	9.8959319	10.1040681	48
13	9.7914359	9.8952440	9.8961918	10.1038082	47
14	9.7915963	9.8951445	9.8964517	10.1035483	46
15	9.7917566	9.8950450	9.8967116	10.1032884	45
16	9.7919168	9.8949453	9.8969714	10.1030286	44
17	9.7920769	9.8948457	9.8972312	10.1027688	43
18	9.7922369	9.8947459	9.8974910	10.1025090	42
19	9.7923968	9.8946461	9.8977507	10.1022493	41
20	9.7925566	9.8945463	9.8980104	10.1019896	40
21	9.7927163	9.8944463	9.8982700	10.1017300	39
22	9.7928760	9.8943464	9.8985296	10.1014704	38
23	9.7930355	9.8942463	9.8987892	10.1012108	37
24	9.7931949	9.8941462	9.8990487	10.1009513	36
25	9.7933543	9.8940461	9.8993082	10.1006918	35
26	9.7935135	9.8939458	9.8995677	10.1004323	34
27	9.7936727	9.8938456	9.8998271	10.1001729	33
28	9.7938317	9.8937452	9.9000865	10.0999135	32
29	9.7939907	9.8936448	9.9003459	10.0996541	31
30	9.7941496	9.8935444	9.9006052	10.0993948	30
31	9.7943083	9.8934439	9.9008645	10.0991355	29
32	9.7944670	9.8933433	9.9011237	10.0988763	28
33	9.7946256	9.8932426	9.9013830	10.0986170	27
34	9.7947841	9.8931419	9.9016422	10.0983578	26
35	9.7949425	9.8930412	9.9019013	10.0980987	25
36	9.7951008	9.8929404	9.9021604	10.0978396	24
37	9.7952590	9.8928395	9.9024195	10.0975805	23
38	9.7954171	9.8927385	9.9026786	10.0973214	22
39	9.7955751	9.8926375	9.9029376	10.0970624	21
40	9.7957330	9.8925365	9.9031966	10.0968034	20
41	9.7958909	9.8924354	9.9034555	10.0965445	19
42	9.7960486	9.8923342	9.9037144	10.0962856	18
43	9.7962062	9.8922329	9.9039733	10.0960267	17
44	9.7963638	9.8921316	9.9042321	10.0957679	16
45	9.7965214	9.8920303	9.9044910	10.0955090	15
46	9.7966786	9.8919289	9.9047497	10.0952503	14
47	9.7968359	9.8918274	9.9050085	10.0949915	13
48	9.7969930	9.8917258	9.9052672	10.0947328	12
49	9.7971501	9.8916242	9.9055259	10.0944741	11
50	9.7973071	9.8915226	9.9057845	10.0942155	10
51	9.7974640	9.8914208	9.9060431	10.0939569	9
52	9.7976208	9.8913191	9.9063017	10.0936983	8
53	9.7977775	9.8912172	9.9065603	10.0934397	7
54	9.7979341	9.8911153	9.9068188	10.0931812	6
55	9.7980906	9.8910133	9.9070773	10.0929227	5
56	9.7982470	9.8909113	9.9073357	10.0926643	4
57	9.7984034	9.8908092	9.9075941	10.0924059	3
58	9.7985596	9.8907071	9.9078525	10.0921475	2
59	9.7987158	9.8906049	9.9081109	10.0918891	1
60	9.7988718	9.8905026	9.9083692	10.0916308	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	51 Degrees				

Min.	39 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.7988718	9.8905026	9.9083692	10.0916308	60
1	9.7990278	9.8904003	9.9086275	10.0913725	59
2	9.7991836	9.8902979	9.9088858	10.0911142	58
3	9.7993394	9.8901954	9.9091440	10.0908560	57
4	9.7994951	9.8900929	9.9094022	10.0905978	56
5	9.7996507	9.8899903	9.9096603	10.0903397	55
6	9.7998062	9.8898877	9.9099185	10.0900815	54
7	9.7999616	9.8897850	9.9101766	10.0898234	53
8	9.8001169	9.8896822	9.9104347	10.0895653	52
9	9.8002721	9.8895794	9.9106927	10.0893073	51
10	9.8004272	9.8894765	9.9109507	10.0890493	50
11	9.8005823	9.8893736	9.9112087	10.0887913	49
12	9.8007372	9.8892706	9.9114666	10.0885334	48
13	9.8008921	9.8891675	9.9117245	10.0882755	47
14	9.8010468	9.8890644	9.9119824	10.0880176	46
15	9.8012015	9.8889612	9.9122403	10.0877597	45
16	9.8013561	9.8888580	9.9124981	10.0875019	44
17	9.8015106	9.8887547	9.9127559	10.0872441	43
18	9.8016649	9.8886513	9.9130137	10.0869863	42
19	9.8018192	9.8885479	9.9132714	10.0867286	41
20	9.8019735	9.8884444	9.9135291	10.0864709	40
21	9.8021276	9.8883408	9.9137868	10.0862132	39
22	9.8022816	9.8882372	9.9140444	10.0859556	38
23	9.8024355	9.8881335	9.9143020	10.0856980	37
24	9.8025894	9.8880298	9.9145596	10.0854404	36
25	9.8027431	9.8879260	9.9148171	10.0851829	35
26	9.8028968	9.8878221	9.9150747	10.0849253	34
27	9.8030504	9.8877182	9.9153322	10.0846678	33
28	9.8032038	9.8876142	9.9155896	10.0844104	32
29	9.8033572	9.8875102	9.9158471	10.0841529	31
30	9.8035105	9.8874061	9.9161045	10.0838955	30
31	9.8036637	9.8873019	9.9163618	10.0836382	29
32	9.8038168	9.8871977	9.9166192	10.0833808	28
33	9.8039699	9.8870934	9.9168765	10.0831235	27
34	9.8041228	9.8869890	9.9171338	10.0828662	26
35	9.8042757	9.8868846	9.9173911	10.0826089	25
36	9.8044284	9.8867801	9.9176483	10.0823517	24
37	9.8045811	9.8866756	9.9179055	10.0820945	23
38	9.8047336	9.8865710	9.9181627	10.0818373	22
39	9.8048861	9.8864663	9.9184198	10.0815802	21
40	9.8050385	9.8863616	9.9186769	10.0813231	20
41	9.8051908	9.8862568	9.9189340	10.0810660	19
42	9.8053430	9.8861519	9.9191911	10.0808089	18
43	9.8054951	9.8860470	9.9194481	10.0805519	17
44	9.8056472	9.8859420	9.9197051	10.0802949	16
45	9.8057991	9.8858370	9.9199621	10.0800379	15
46	9.8059510	9.8857319	9.9202191	10.0797809	14
47	9.8061027	9.8856267	9.9204760	10.0795240	13
48	9.8062544	9.8855215	9.9207329	10.0792671	12
49	9.8064060	9.8854162	9.9209898	10.0790102	11
50	9.8065575	9.8853109	9.9212466	10.0787534	10
51	9.8067089	9.8852055	9.9215034	10.0784966	9
52	9.8068602	9.8851000	9.9217602	10.0782398	8
53	9.8070114	9.8849945	9.9220170	10.0779830	7
54	9.8071626	9.8848889	9.9222737	10.0777263	6
55	9.8073136	9.8847832	9.9225304	10.0774696	5
56	9.8074646	9.8846775	9.9227871	10.0772129	4
57	9.8076154	9.8845717	9.9230437	10.0769563	3
58	9.8077662	9.8844659	9.9233004	10.0766996	2
59	9.8079169	9.8843599	9.9235570	10.0764430	1
60	9.8080673	9.8842540	9.9238135	10.0761865	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	50 Degrees				

Min.	40 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.8080675	9.8842540	9.9238135	10.0761807	60
1	9.8082180	9.8841479	9.9240701	10.0759299	59
2	9.8083684	9.8840418	9.9243266	10.0756734	58
3	9.8085188	9.8839357	9.9245831	10.0754169	57
4	9.8086690	9.8838294	9.9248396	10.0751604	56
5	9.8088192	9.8837232	9.9250960	10.0749040	55
6	9.8089692	9.8836168	9.9253524	10.0746476	54
7	9.8091192	9.8835104	9.9256088	10.0743912	53
8	9.8092691	9.8834039	9.9258652	10.0741348	52
9	9.8094189	9.8832974	9.9261215	10.0738785	51
10	9.8095686	9.8831908	9.9263778	10.0736222	50
11	9.8097182	9.8830841	9.9266341	10.0733659	49
12	9.8098678	9.8829774	9.9268904	10.0731096	48
13	9.8100172	9.8828706	9.9271466	10.0728534	47
14	9.8101666	9.8827638	9.9274028	10.0725972	46
15	9.8103159	9.8826568	9.9276590	10.0723410	45
16	9.8104650	9.8825499	9.9279152	10.0720848	44
17	9.8106141	9.8824428	9.9281713	10.0718287	43
18	9.8107631	9.8823357	9.9284274	10.0715720	42
19	9.8109121	9.8822285	9.9286835	10.0713165	41
20	9.8110609	9.8821213	9.9289396	10.0710604	40
21	9.8112096	9.8820140	9.9291956	10.0708044	39
22	9.8113583	9.8819067	9.9294516	10.0705484	38
23	9.8115069	9.8817992	9.9297076	10.0702924	37
24	9.8116554	9.8816918	9.9299636	10.0700364	36
25	9.8118038	9.8815842	9.9302195	10.0697805	35
26	9.8119521	9.8814766	9.9304755	10.0695245	34
27	9.8121003	9.8813689	9.9307314	10.0692686	33
28	9.8122484	9.8812612	9.9309872	10.0690128	32
29	9.8123965	9.8811534	9.9312431	10.0687569	31
30	9.8125444	9.8810455	9.9314989	10.0685011	30
31	9.8126923	9.8809376	9.9317547	10.0682453	29
32	9.8128401	9.8808296	9.9320105	10.0679895	28
33	9.8129878	9.8807215	9.9322662	10.0677338	27
34	9.8131354	9.8806134	9.9325220	10.0674780	26
35	9.8132829	9.8805052	9.9327777	10.0672223	25
36	9.8134303	9.8803970	9.9330334	10.0669666	24
37	9.8135777	9.8802887	9.9333890	10.0667110	23
38	9.8137250	9.8801803	9.9335446	10.0664554	22
39	9.8138721	9.8800719	9.9338003	10.0661997	21
40	9.8140192	9.8799634	9.9340559	10.0659441	20
41	9.8141662	9.8798548	9.9343114	10.0656886	19
42	9.8143131	9.8797462	9.9345670	10.0654330	18
43	9.8144600	9.8796375	9.9348225	10.0651775	17
44	9.8146067	9.8795287	9.9350780	10.0649220	16
45	9.8147534	9.8794199	9.9353335	10.0646665	15
46	9.8148999	9.8793110	9.9355889	10.0644111	14
47	9.8150464	9.8792021	9.9358444	10.0641556	13
48	9.8151928	9.8790930	9.9360998	10.0639002	12
49	9.8153391	9.8789840	9.9363552	10.0636448	11
50	9.8154854	9.8788748	9.9366105	10.0633895	10
51	9.8156315	9.8787656	9.9368659	10.0631341	9
52	9.8157776	9.8786563	9.9371212	10.0628788	8
53	9.8159235	9.8785470	9.9373765	10.0626235	7
54	9.8160694	9 8784376	9.9376318	10.0623682	6
55	9.8162152	9.8783281	9.9378871	10.0621129	5
56	9.8163609	9.8782186	9.9381423	10.0618577	4
57	9.8165066	9.8781090	9.9383975	10.0616025	3
58	9.8166521	9.8779994	9.9386527	10.0613473	2
59	9.8167975	9.8778896	9.9389079	10.0610921	1
60	9.8169429	9.8777799	9.9391631	10.0608369	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	49 Degrees				

Min.	41 Degrees				
	Sine	Sine Comp,	Tang.	Tang. Comp	
0	9.8109429	9.8777799	9.9391631	10.0608369	60
1	9.8170882	9.8776700	9.9394182	10.0605818	59
2	9.8172334	9.8775601	9.9396733	10.0603267	58
3	9.8173785	9.8774501	9.9399284	10.0600716	57
4	9.8175235	9.8773401	9.9401835	10.0598165	56
5	9.8176685	9.8772300	9.9404385	10.0595615	55
6	9.8178133	9.8771198	9.9406936	10.0593064	54
7	9.8179581	9.8770096	9.9409486	10.0590514	53
8	9.8181028	9.8768993	9.9412036	10.0587964	52
9	9.8182474	9.8767889	9.9414585	10.0585415	51
10	9.8183919	9.8766785	9.9417135	10.0582865	50
11	9.8185364	9.8765680	9.9419684	10.0580316	49
12	9.8186807	9.8764574	9.9422233	10.0577767	48
13	9.8188250	9.8763468	9.9424782	10.0575218	47
14	9.8189692	9.8762361	9.9427331	10.0572669	46
15	9.8191133	9.8761253	9.9429879	10.0570121	45
16	9.8192573	9.8760145	9.9432428	10.0567572	44
17	9.8194012	9.8759036	9.9434976	10.0565024	43
18	9.8195450	9.8757927	9.9437524	10.0562476	42
19	9.8196888	9.8756816	9.9440072	10.0559928	41
20	9.8198325	9.8755706	9.9442619	10.0557381	40
21	9.8199761	9.8754594	9.9445166	10.0554834	39
22	9.8201196	9.8753482	9.9447714	10.0552286	38
23	9.8202630	9.8752369	9.9450261	10.0549739	37
24	9.8204063	9.8751256	9.9452807	10.0547193	36
25	9.8205496	9.8750142	9.9455354	10.0544646	35
26	9.8206927	9.8749027	9 9457900	10.0542100	34
27	9.8208358	9.8747912	9.9460447	10.0539553	33
28	9.8209788	9.8746795	9.9462993	10.0537007	32
29	9.8211217	9.8745679	9.9465539	10.0534461	31
30	9.8212646	9.8744561	9.9468084	10.0531916	30
31	9.8214073	9.8743443	9.9470630	10.0529370	29
32	9.8215500	9.8742325	9.9473175	10.0526825	28
33	9.8216926	9.8741205	9.9475720	10.0524280	27
34	9.8218351	9.8740085	9.9478265	10.0521735	26
35	9.8219775	9.8738965	9.9480810	10.0519190	25
36	9.8221198	9.8737844	9.9483355	10.0516645	24
37	9.8222621	9.8736722	9.9485899	10.0514101	23
38	9.8224042	9.8735599	9.9488443	10.0511557	22
39	9.8225463	9.8734476	9.9490987	10.0509013	21
40	9.8226883	9.8733352	9.9493531	10.0506469	20
41	9.8228302	9.8732227	9.9496075	10.0503925	19
42	9.8229721	9.8731102	9.9498619	10.0501381	18
43	9.8231138	9.8729976	9.9501162	10.0498838	17
44	9.8232555	9.8728849	9.9503705	10.0496295	16
45	9.8233971	9.8727722	9.9506248	10.0493752	15
46	9.8235386	9.8726594	9.9508791	10.0491209	14
47	9.8236800	9.8725466	9.9511334	10.0488666	13
48	9.8238213	9.8724337	9.9513876	10.0486124	12
49	9.8239626	9.8723207	9.9516419	10.0483581	11
50	9.8241037	9.8722076	9.9518961	10.0481039	10
51	9.8242448	9.8720945	9.9521503	10.0478497	9
52	9.8243858	9.8719813	9.9524045	10.0475955	8
53	9.8245267	9.8718681	9.9526587	10.0473413	7
54	9.8246676	9.8717548	9.9529128	10.0470872	6
55	9.8248083	9.8716414	9.9531670	10.0468330	5
56	9.8249490	9.8715279	9.9534211	10.0465789	4
57	9.8250896	9.8714144	9.9536752	10.0463248	3
58	9.8252301	9.8713008	9.9539293	10.0460707	2
59	9.8253705	9.8711872	9.9541834	10.0458166	1
60	9.8255109	9.8710735	9.9544374	10.0455626	0
	Sine Comp	Sine	Tang. Com	Tang.	Min.
	48 Degrees				

Min.	42 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.8255109	9.8710735	9.9544374	10.0455626	60
1	9.8256512	9.8709597	9.9546915	10.0453085	59
2	9.8257913	9.8708458	9.9549455	10.0450545	58
3	9.8259314	9.8707319	9.9551995	10.0448005	57
4	9.8260715	9.8706179	9.9554535	10.0445465	56
5	9.8262114	9.8705039	9.9557075	10.0442925	55
6	9.8263512	9.8703898	9.9559615	10.0440385	54
7	9.8264910	9.8702756	9.9562154	10.0437846	53
8	9.8266307	9.8701613	9.9564964	10.0435306	52
9	9.8267703	9.8700470	9.9567233	10.0432767	51
10	9.8269098	9.8699326	9.9569772	10.0430228	50
11	9.8270493	9.8698182	9.9572311	10.0427689	49
12	9.8271887	9.8697037	9.9574850	10.0425150	48
13	9.8273279	9.8695891	9.9577389	10.0422611	47
14	9.8274671	9.8694744	9.9579927	10.0420073	46
15	9.8276063	9.8693597	9.9582465	10.0417535	45
16	9.8277453	9.8692449	9.9585004	10.0414996	44
17	9.8278843	9.8691301	9.9587542	10.0412458	43
18	9.8280231	9.8690152	9.9590080	10.0409920	42
19	9.8281619	9.8689002	9.9592618	10.0407382	41
20	9.8283006	9.8687851	9.9595155	10.0404845	40
21	9.8284393	9.8686700	9.9597693	10.0402307	39
22	9.8285778	9.8685548	9.9600230	10.0399770	38
23	9.8287163	9.8684396	9.9602767	10.0397233	37
24	9.8288547	9.8683242	9.9605305	10.0394695	36
25	9.8289930	9.8682088	9.9607842	10.0392158	35
26	9.8291312	9.8680934	9.9610378	10.0389622	34
27	9.8292694	9.8679779	9.9612915	10.0387085	33
28	9.8294075	9.8678623	9.9615452	10.0384548	32
29	9.8295454	9.8677466	9.9617988	10.0382012	31
30	9.8296833	9.8676309	9.9620525	10.0379475	30
31	9.8298212	9.8675151	9.9623061	10.0376939	29
32	9.8299589	9.8673992	9.9625597	10.0374403	28
33	9.8300966	9.8672833	9.9628133	10.0371867	27
34	9.8302342	9.8671673	9.9630669	10.0369331	26
35	9.8303717	9.8670512	9.9633204	10.0366796	25
36	9.8305091	9.8669351	9.9635740	10.0364260	24
37	9.8306464	9.8668189	9.9638275	10.0361725	23
38	9.8307837	9.8667026	9.9640811	10.0359189	22
39	9.8309209	9.8665863	9.9643346	10.0356654	21
40	9.8310580	9.8664699	9.9645881	10.0354119	20
41	9.8311950	9.8663534	9.9648416	10.0351584	19
42	9.8313320	9.8662369	9.9650951	10.0349049	18
43	9.8314688	9.8661203	9.9653486	10.0346514	17
44	9.8316056	9.8660036	9.9656020	10.0343980	16
45	9.8317423	9.8658868	9.9658555	10.0341445	15
46	9.8318789	9.8657700	9.9661089	10.0338911	14
47	9.8320155	9.8656531	9.9663623	10.0336377	13
48	9.8321519	9.8655362	9.9666157	10.0333843	12
49	9.8322883	9.8654192	9.9668692	10.0331308	11
50	9.8324246	9.8653021	9.9671225	10.0328775	10
51	9 8325609	9.8651849	9.9673759	10.0326241	9
52	9.8326970	9.8650677	9.9676293	10.0323707	8
53	9.8328331	9.8649504	9.9678827	10.0321173	7
54	9.8329691	9.8648331	9.9681360	10.0318640	6
55	9.8331050	9.8647156	9.9683893	10.0316107	5
56	9.8332408	9.8645981	9.9686427	10.0313573	4
57	9.8333766	9.8644806	9.9688960	10.0311040	3
58	9.8335122	9.8643629	9.9691493	10.0308507	2
59	9.8336478	9.8642452	9.9694026	10.0305974	1
60	9.8337833	9.8641275	9.9696559	10.0303441	0
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	47 Degrees				

Min.	43 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp	
0	9.8337833	9.8641275	9.9696559	10.0303441	60
1	9.8339188	9.8640096	9.9699091	10.0300909	59
2	9.8340541	9.8638917	9.9701624	10.0298376	58
3	9.8341894	9.8637737	9.9704157	10.0295843	57
4	9.8343246	9.8636557	9.9706689	10.0293311	56
5	9.8344597	9.8635376	9.9709221	10.0290779	55
6	9.8345948	9.8634194	9.9711754	10.0288246	54
7	9.8347297	9.8633011	9.9714286	10.0285714	53
8	9.8348646	9.8631828	9.9716818	10.0283182	52
9	9.8349994	9.8630644	9.9719350	10.0280650	51
10	9.8351341	9.8629460	9.9721882	10.0278118	50
11	9.8352688	9.8628274	9.9724413	10.0275587	49
12	9.8354033	9.8627088	9.9726945	10.0273055	48
13	9.8355378	9.8625902	9.9729477	10.0270523	47
14	9.8356722	9.8624714	9.9732008	10.0267992	46
15	9.8358066	9.8623526	9.9734539	10.0265461	45
16	9.8359408	9.8622338	9.9737071	10.0262929	44
17	9.8360750	9.8621148	9.9739602	10.0260398	43
18	9.8362091	9.8619958	9.9742133	10.0257867	42
19	9.8363431	9.8618767	9.9744664	10.0255336	41
20	9.8364771	9.8617576	9.9747195	10.0252805	40
21	9.8366109	9.8616383	9.9749726	10.0250274	39
22	9.8367447	9.8615190	9.9752257	10.0247743	38
23	9.8368784	9.8613997	9.9754787	10.0245213	37
24	9.8370121	9.8612803	9.9757318	10.0242682	36
25	9.8371456	9.8611608	9.9759849	10.0240151	35
26	9.8372791	9.8610412	9 9762379	10.0237621	34
27	9.8374125	9.8609215	9.9764909	10.0235091	33
28	9.8375458	9.8608018	9.9767440	10.0232560	32
29	9.8376790	9.8606821	9.9769970	10.0230030	31
30	9.8378122	9.8605622	9.9772500	10.0227500	30
31	9.8379453	9.8604423	9.9775030	10.0224970	29
32	9.8380783	9.8603223	9.9777560	10.0222440	28
33	9.8382112	9.8602022	9.9780090	10.0219910	27
34	9.8383441	9.8600821	9.9782620	10.0217380	26
35	9.8384769	9.8599619	9.9785149	10.0214851	25
36	9.8386096	9.8598416	9.9787679	10.0212321	24
37	9.8387422	9.8597213	9.9790209	10.0209791	23
38	9.8388747	9.8596009	9.9792738	10.0207262	22
39	9.8390072	9.8594804	9.9795268	10.0204732	21
40	9.8391396	9.8593599	9.9797797	10.0202203	20
41	9.8392719	9.8592393	9.9800326	10.0199674	19
42	9.8394041	9.8591186	9.9802856	10.0197144	18
43	9.8395363	9.8589978	9.9805385	10.0194615	17
44	9.8396684	9.8588770	9.9807914	10 0192086	16
45	9.8398004	9.8587561	9.9810443	10.0189557	15
46	9.8399323	9.8586351	9.9812972	10.0187028	14
47	9.8400642	9.8585141	9.9815501	10.0184499	13
48	9.8401959	9.8583929	9.9818030	10.0181970	12
49	9.8403276	9.8582718	9.9820559	10.0179441	11
50	9.8404593	9.8581505	9.9823087	10.0176913	10
51	9.8405908	9.8580292	9.9825616	10.0174384	9
52	9.8407223	9.8579078	9.9828145	10.0171855	8
53	9.8408537	9.8577863	9.9830673	10.0169327	7
54	9.8409850	9.8576648	9.9833202	10.0166798	6
55	9.8411162	9.8575432	9.9835730	10.0164270	5
56	9.8412474	9.8574215	9.9838259	10.0161741	4
57	9.8413785	9.8572998	9.9840787	10.0159213	3
58	9.8415095	9.8571779	9.9843315	10.0156685	2
59	9.8416404	9.8570561	9.9845844	10.0154156	1
60	9.8417713	9.8579341	9.9848372	10.0151628	0
	Sine Comp	Sine	Tang. Com.	Tang.	Min.
	46 Degrees				

Min.	44 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp.	
0	9.8417713	9.8569349	9.9848372	10.0151628	60
1	9.8419021	9.8568121	9.9850900	10.0149100	59
2	9.8420328	9.8566900	9.9853428	10.0146752	58
3	9.8421634	9.8565678	9.9855956	10.0144044	57
4	9.8422939	9.8564455	9.9858484	10.0141516	56
5	9.8424244	9.8563232	9.9861012	10.0138988	55
6	9.8425548	9.8562008	9.9863540	10.0136460	54
7	9.8426851	9.8560784	9.9866068	10.0133932	53
8	9.8428154	9.8559558	9.9868596	10.0131404	52
9	9.8429456	9.8558332	9.9871123	10.0128877	51
10	9.8430757	9.8557106	9.9873651	10.0126349	50
11	9.8432057	9.8555878	9.9876179	10.0123821	49
12	9.8433356	9.8554650	9.9878706	10.0121294	48
13	9.8434655	9.8553421	9.9881234	10.0118766	47
14	9.8435953	9.8552192	9.9883761	10.0116239	46
15	9.8437250	9.8550961	9.9886289	10.0113711	45
16	9.8438547	9.8549730	9.9888816	10.0111184	44
17	9.8439842	9.8548499	9.9891344	10.0108656	43
18	9.8441137	9.8547266	9.9893871	10.0106129	42
19	9.8442423	9.8546033	9.9896399	10.0103601	41
20	9.8443725	9.8544799	9.9898926	10.0101074	40
21	9.8445018	9.8543564	9.9901453	10.0098547	39
22	9.8446310	9.8542329	9.9903981	10.0096019	38
23	9.8447601	9.8541093	9.9906508	10.0093492	37
24	9.8448891	9.8539856	9.9909035	10.0090965	36
25	9.8450181	9.8538619	9.9911562	10.0088438	35
26	9.8451470	9.8537381	9.9914089	10.0085911	34
27	9.8452758	9.8536142	9.9916616	10.0083384	33
28	9.8454045	9.8534902	9.9919143	10.0080857	32
29	9.8455332	9.8533662	9.9921670	10.0078330	31
30	9.8456618	9.8532421	9.9924197	10.0075803	30
	Sine Comp.	Sine	Tang. Com.	Tang.	Min.
	45 Degrees				

Min.	44 Degrees				
	Sine	Sine Comp.	Tang.	Tang. Comp	
30	9.8456618	9.8532421	9.9924197	10.0075803	30
31	9.8457903	9.8531179	9.9926724	10.0073276	29
32	9.8459188	9.8529936	9.9929251	10.0070749	28
33	9.8460471	9.8528693	9.9931778	10.0068222	27
34	9,8461754	9.8527449	9.9934305	10.0065695	26
35	9.8463036	9.8526204	9.9936832	10.0063168	25
36	9.8464318	9.8524959	9.9939359	10.0060641	24
37	9.8465599	9.8523713	9.9941886	10.0058114	23
38	9.8466879	9.8522466	9.9944413	10.0055587	22
39	9.8468158	9.8521218	9.9946940	10.0053060	21
40	9.8469436	9.8519970	9.9949466	10.0050534	20
41	9.8470714	9.8518721	9.9951993	10.0048007	19
42	9.8471991	9.8517471	9.9954520	10.0045480	18
43	9.8473267	9.8516220	9.9957047	10.0042953	17
44	9.8474543	9.8514969	9.9959573	10.0040427	16
45	9.8475817	9.8513717	9.9962100	10.0037900	15
46	9.8477091	9.8512465	9.9964627	10.0035373	14
47	9.8478365	9.8511211	9.9967154	10.0032846	13
48	9.8479637	9.8509957	9.9969680	10.0030320	12
49	9.8480909	9.8508702	9.9972207	10.0025793	11
50	9.8482180	9.8507446	9.9974734	10.0022266	10
51	9.8483450	9.8506190	9.9977260	10.0022740	9
52	9.8484720	9.8504933	9.9979787	10.0020213	8
53	9.8485989	9.8503675	9.9982314	10.0017686	7
54	9.8487257	9.8502417	9.9984840	10.0015160	6
55	9.8488524	9.8501157	9.9987367	10.0012633	5
56	9.8489791	9.8499897	9.9989893	10.0010107	4
57	9.8491057	9.8498637	9.9992420	10.0007580	3
58	9.8492322	9.8497375	9.9994947	10.0005053	2
59	9.8493586	9.8496113	9.9997473	10.0002527	1
60	9.8494850	9.8494850	10.0000000	10.0000000	0
	Sine Comp.	Sine	Tang. Comp	Tang.	Min.
	45 Degrees				

Logarithmic curve. Plate CCLXXIII fig. 3.

LOGARITHMIC curve. If on the line A N both ways indefinitely extended, be taken A C, C E, E G, G I, I L, on the right hand; and alſo A *g*, *g* P, &c. on the left, all equal to one another: and if at the points P *g*, A, C, E, G, I, L, be erected to the right line A N, the perpendiculars P S, *g d*, A B, C D, E F, G H, I K, L M, which let be continually proportional, and repreſent numbers, viz AB, 1; CD, 10; EF, 100, &c. then ſhall we have two progreſſions of lines, arithmetical and geometrical: for the lines A C, A E, A G, &c. are in arithmetical progreſſion, or as 1, 2, 3, 4, 5, &c. and ſo repreſent the logarithms to which the geometrical lines A B, C D, E F, &c. do correſpond. For ſince A G is triple of the firſt line A C, the number G H ſhall be in the third place from unity,' if C D be in the firſt: ſo likewiſe ſhall L M be in the fifth place, ſince AL=5 AC. If the extremities of the proportionals S, *d*, B, D, F, &c. be joined by right lines, the figures S B M L will become a polygon, conſiſting of more or leſs ſides, according as there are more or leſs terms in the progreſſion.

If the parts A C, C E, E G, &c. be biſected in the points *c*, *e*, *g*, *i*, *l*, and there be again raiſed the perpendiculars, *c d*, *e f*, *g h*, *i k*, *l m*, which are mean proportionals between A B, C D, C D, E F, &c. then there will ariſe a new ſeries of proportionals, whoſe terms, beginning from that which immediately follows unity, are double of thoſe in the firſt ſeries, and the difference of the terms is become leſs, and approach nearer to a ratio of equality than before. Likewiſe, in this new ſeries, the right lines A L, A *c*, expreſs the diſtances of the terms L M, *c d*, from unity, viz. ſince A L is ten times greater than A *c*, L M ſhall be the tenth term of the ſeries from unity: and becauſe A *e* is three times greater than A *c*, *e f* will be the third term of the ſeries if *c d* be the firſt, and there ſhall be two mean proportionals between A B and *e f*, and between A B and L M there will be nine mean proportionals. And if the extremities of the lines B *d*, D *f*, F *h*, &c. be joined by right lines, there will be a new polygon made, conſiſting of more but ſhorter ſides than the laſt.

If, in this manner, mean proportionals be continually placed between every two terms, the number of terms at laſt will be made ſo great, as alſo the number of the ſides of the polygon, as to be greater than any given number, or to be infinite; and every ſide of the polygon ſo leſſened, as to become leſs than any given right line; and conſequently the polygon will be changed into a curve-lined figure; for any curve-lined figure may be conceived as a polygon, whoſe ſides are infinitely ſmall and infinite in number. A curve deſcribed after this manner is called *logarithmical*.

It is manifeſt from this deſcription of the logarithmic curve, that all numbers at equal diſtances are continually,

Logarithmic curve.

tinually proportional. It is alſo plain, that if there be four numbers, AB, CD IK, LM, ſuch that the diſtance between the firſt and ſecond be equal to the diſtance between the third and the fourth, let the diſtance from the ſecond to the third be what it will, theſe numbers will be proportional. For becauſe the diſtances AC, IL, are equal, AB ſhall be to the increment D *s*, as IK is to the increment MT. Wherefore, by compoſition, AB : DC : : IK : ML. And, contrariwiſe, if four numbers be proportional, the diſtance between the firſt and ſecond ſhall be equal to the diſtance between the third and fourth.

The diſtance between any two numbers is called *the logarithm of the ratio of thoſe numbers*; and, indeed, doth not meaſure the ratio itſelf, but the number of terms in a given ſeries of geometrical proportionals, proceeding from one number to another, and defines the number of equal ratios by the compoſition whereof the ratios of number is known.

Logarithmic Lines. For many mechanical purpoſes it is convenient to have the logarithms of numbers laid down on ſcales, as well as the logarithmic ſines and tangents; by which means, computations may be carried on by mere menſuration with compaſſes. Lines of this kind are always put on the common Gunter's ſcale; but as theſe inſtruments muſt be extended to a very great length, in order to contain any conſiderable quantity of numbers, it becomes an object of importance to ſhorten them. Such an improvement has been made by Mr William Nicholſon, and publiſhed in the 77th volume of the Philoſophical Tranſactions. The principles on which the conſtruction of his inſtruments depends are as follow:

1. If two geometrical ſeries of numbers, having the ſame common ratio, be placed in order with the terms oppoſite to each other, the ratio between any term in one ſeries and its oppoſite in the other will be conſtant: Thus,

2 6 18 54 162, &c.
3 9 27 81 243, &c. Then,
2 3 6 9 18 27 54 81 162 243, &c.

where it is evident, that each of the terms in the upper ſeries is exactly two-thirds of the correſponding one in the lower.

2. The ratio of any two terms in one ſeries will be the ſame with that between thoſe which have an equal diſtance in the other.

3. In all ſuch geometrical ſeries as have the ſame ratio, the property abovementioned takes place, tho' we compare the terms of any ſeries with thoſe of another: Thus,

$$\begin{cases} 2 \quad 4 \quad 8 \quad 16 \quad 32 \quad 64, \text{\&c.} \\ 3 \quad 6 \quad 12 \quad 24 \quad 48 \quad 96, \text{\&c.} \end{cases}$$

$$\begin{cases} 4 \quad 8 \quad 16 \quad 32 \quad 64 \quad 128, \text{\&c.} \\ 5 \quad 10 \quad 20 \quad 40 \quad 80 \quad 160, \text{\&c.}; \end{cases}$$

where it is plain that 2, 4, 3, 6; alſo 2, 4, 4, 8, and 2, 4, 5, 10, &c. have the ſame ratio with that of each ſeries.

4. If the differences of the logarithms of the numbers be laid in order upon equidiſtant parallel right lines, in ſuch a manner that a right line drawn acroſs the whole ſhall interſect it at diviſions denoting numbers in geometrical progreſſion; then, from the condition of the arrangement, and the property of this logarithmic line, it follows, 1ſt, That every right line ſo drawn will, by its interſections, indicate a geometrical ſeries of numbers; 2dly, That ſuch ſeries as are indicated by theſe right lines will have the ſame common ratio; and, 3dly, That the ſeries thus indicated by two parallel right lines, ſuppoſed to move laterally, without changing either their mutual diſtance or parallelism to themſelves, will have each the ſame ratio, and in all ſeries indicated by ſuch two lines, the ratio between an antecedent and conſequent; the former taken upon one line, and the latter upon another, will be alſo the ſame.

Plate CCLXXIII fig. 11.

The 1*ſt* of theſe propoſitions is proved in the following manner. Let the lines AB, CD, EF, repreſent parts of the logarithmic line arranged according to the proportion already mentioned; and let GH be a right line paſſing through the points *e*, *c*, *a*, denoting numbers in geometrical progreſſion; then will any other line IK, drawn acroſs the arrangement, likewiſe paſs through three points *f*, *d*, *b*, in geometrical progreſſion. From one of the points of interſection *f* in the laſt mentioned line IK, draw the line *fg* parallel to GH, and interſecting the arrangement in the points *i*, *h*; and the ratios of the numbers *e*, *f*, *c*, *i*, will be equal, as well as of *d*, *h*; becauſe the intervals on the logarithmic line, or differences of the logarithms of thoſe numbers, are equal. Again, the point *f*, the line *id*, and the line *hb*, are in arithmetical progreſſion denoting the differences between the logarithms of the numbers themſelves; whence the quotients of the numbers are in geometrical progreſſion.

The 2*d* propoſition is proved in a ſimilar manner. For as it was ſhown that the line *fg*, parallel to GH, paſſes through points of diviſion denoting numbers in the ſame continued ratio as thoſe indicated by the line GH; it may alſo be ſhown, that the line LM parallel to any other line IK, will paſs through a ſeries of points denoting numbers which have the ſame continued ratio with thoſe indicated by the line IK, to which it is parallel.

The 3*d* propoſition ariſes from the parallelism of the lines to their former ſituation; by which means they indicate numbers in a geometrical ſeries, having the ſame common ratio as before: their diſtance on the logarithmic line alſo remains unchanged; whence the differences between the logarithms of the oppoſite numbers, and of conſequence their ratios, will always be conſtant.

5. Suppoſing now an antecedent and conſequent to be given in any geometrical ſeries, it will always be poſſible to find them, provided the line be of unlimited length. Drawing two parallel lines, then, through each of the numbers, and ſuppoſing the lines to move without changing their direction or parallel ſituation, they will continually deſcribe new antecedents and conſequents in the ſame geometrical ſeries as before.

6. Though the logarithmic line contain no greater range of numbers than from 1 to 10, it will not be found neceſſary for the purpoſes of computation to repeat it. The only thing requiſite is to have a ſlider or beam with two fixed points at the diſtance of the interval betwixt 1 and 10, and a moveable point be made to range betwixt them always to indicate the antecedent; then, if the conſequent fixed point fall without the rule, the other fixed point will always denote the diviſion on which it would have fallen had the rule been prolonged; and this contrivance may eaſily be adapted to any arrangement of parallel lines whatever. The arrangement of right lines, however, ought always to be diſpoſed in ſuch a manner as to occupy a

Logarithmic Lines.

right angled parallelogram, or the croſs line already mentioned ought always to be at right angles to the length of the ruler.

Fig. 7. is a ruler conſiſting of ten parallel lines. Fig. 8. a beam-compaſs for meaſuring the intervals. B, A, C, are the parts which apply to the ſurface of the ruler; the middle one, A, being moveable ſidewiſe in a groove in the piece DE, ſo as always to preſerve its paralleliſm to the external pieces DC, which are fixed at a diſtance equal to the length of the ruler, and have their edges placed in ſuch a manner as to form with the parallel lines which they interſect a ratio, which by compoſition is $\frac{1}{10}$; which in the preſent caſe requires them to be at right angles to the length. The piece DE is applied to the edge FG of the ruler. The edges or borders H, I, K, L, are more conveniently made of tranſparent horn, or tortoiſe-ſhell, than of any opaque matter.

In uſing this ruler, apply the edge of either B or C to the conſequent, and ſlide the piece A to the antecedent; obſerving the difference between the numbers on the pieces denoting the lines they are found on: then, applying the ſame edge of A to any other antecedent, the other piece B or C will interſect a conſequent in the ſame ratio upon that line, having the ſame ſituation with regard to the antecedent that the line of the former conſequent had to its antecedent. But if B be the conſequent piece, and fall without the ruler, the piece C will ſhow the conſequent one line lower; or if C, in like manner, fall without the ruler, then B will ſhow the conſequent one line higher. "It might be convenient (ſays Mr Nicholſon) for the purpoſe of computation, to make inſtruments of this kind with one hundred or more lines: but in the preſent inſtrument, the numbers on the pieces will anſwer the ſame purpoſe; for if a conſequent fall upon a line at any given number of intervals without the ruler, it will be found on that line of the arrangement which occupies the ſame number of intervals reckoned inwards from the oppoſite edge of the ruler."

Fig. 9. is an inſtrument on the plan of a Gunter's ſcale of 28½ inches long, invented by the late Mr Robertſon. There is a moveable piece AB in the ſlider GH, acroſs which is drawn a fine line: the ſlider having alſo lines CD, EF, drawn acroſs it at diſtances from each other equal to the length of the ruler AB. In uſing the inſtrument, the line CD or EF is to be placed at the conſequent, and the line in AB at the antecedent: then, if the piece AB be placed at any other antecedent, the ſame line CD or EF will indicate its conſequent in the ſame ratio taken the ſame way: that is, if the antecedent and conſequent lie on the ſame ſide of the ſlider, all other antecedents and conſequents in that ratio will be in the ſame manner; and the contrary if they do not. But if the conſequent line fall without the rule, the other fixed line on the ſlider will ſhow the conſequent, but on the contrary ſide of the ſlider to that where it would elſe have been ſeen by means of the firſt conſequent line.

Logarithmic Lines.

Fig. 10. is a circular inſtrument equivalent to the former; conſiſting of three concentric circles engraved and graduated upon a plate of an inch and an half diameter. Two legs A and B proceed from the centre, having right-lined edges in the direction of radii; and are moveable either ſingly or together. In uſing the inſtrument, place one of the edges at the antecedent and the other at the conſequent, and fix them at the angle. Move the two legs then together; and having placed the antecedent leg at any other number, the other will give the conſequent one in the like poſition on the lines. If the line CD happen to lie between the legs, and B be the conſequent leg, the number ſought will be found one line farther from the centre than it would otherwiſe have been; and on the contrary, it will be found one line nearer in the like caſe, if A be the conſequent leg. "This inſtrument (ſays Mr Nicholſon) differing from that repreſented fig. 7. only in its circular form, and the advantages reſulting from that form, the lines muſt be taken to ſucceed each other in the ſame manner laterally; ſo that numbers which fall either within or without the arrangement of circles, will be found on ſuch lines of the arrangement as would have occupied the vacant places if the ſucceſſion of lines had been indefinitely repeated ſidewiſe.

"I approve of this conſtruction as ſuperior to every other which has yet occurred to me, not only in point of convenience, but likewiſe in the probability of being better executed; becauſe ſmall arcs may be graduated with very great accuracy, by diviſions transferred from a larger original. The inſtrument, fig. 7. may be contained conveniently in a circle of about four inches and an half diameter.

"The circular inſtrument is a combination of the Gunter's line and the ſector, with the improvements here pointed out. The property of the ſector may be uſeful in magnifying the differences of the logarithms in the upper parts of the line of ſines, the middle of the tangents, and the beginning of the verſed ſines. It is even poſſible, as mathematicians will eaſily conceive, to draw ſpirals, on which graduations of parts, every where equal to each other, will ſhow the ratios of thoſe lines by moveable radii, ſimilar to thoſe in this inſtrument."

LOGIC.

LOGIC is the art of thinking and reaſoning juſtly; or, it may be defined the ſcience or hiſtory of the human mind, inaſmuch as it traces the progreſs of our knowledge from our firſt and moſt ſimple conceptions through all their different combinations, and all thoſe numerous deductions that reſult from variouſly comparing them one with another.

The preciſe buſineſs of logic therefore is, To explain the nature of the human mind, and the proper manner of conducting its ſeveral powers, in order to the attainment of truth and knowledge. It lays open thoſe errors and miſtakes we are apt, through inattention, to run into; and teaches us how to diſtinguiſh between truth, and what only carries the appearance of it. By theſe means we grow acquainted with the nature and force of the underſtanding; ſee what things lie within its reach; where we may attain certainty and demonſtration; and when we muſt be contented with probability.

This ſcience is generally divided into four parts, viz. *Perception*, *Judgment*, *Reaſoning*, and *Method.* This diviſion comprehends the whole hiſtory of the ſenſations and operations of the human mind.

PART I. OF PERCEPTION.

WE find ourſelves ſurrounded with a variety of objects, which acting differently upon our ſenſes, convey diſtinct impreſſions into the mind, and thereby rouſe the attention and notice of the underſtanding. By reflecting too on what paſſes within us, we become ſenſible of the operations of our own minds, and attend to them as a new ſet of impreſſions. But in all this there is only bare *conſciouſneſs*. The mind, without proceeding any farther, takes notice of the impreſſions that are made upon it, and views things in order, as they preſent themſelves one after another. This attention of the underſtanding to the object acting upon it, whereby it becomes ſenſible of the impreſſions they make, is called by logicians *perception;* and the notices themſelves, as they exiſt in the mind, and are there treaſured up to be the materials of thinking and knowledge, are diſtinguiſhed by the name of *ideas*. In the article METAPHYSICS it ſhall be ſhown at large, how the mind, being furniſhed with ideas, contrives to diverſify and enlarge its ſtock: we have here chiefly to conſider the means of making known our thoughts to others; that we may not only underſtand how knowledge is acquired, but alſo in what manner it may be communicated with the greateſt certainty and advantage.

CHAP. I. *Of Words, conſidered as the Signs of our Ideas.*

1 Words furniſh the means of recording our own thoughts;

I. OUR ideas, though manifold and various, are nevertheleſs all within our own breaſts, inviſible to others, nor can of themſelves be made appear. But God, deſigning us for ſociety, and to have fellowſhip with thoſe of our kind, has provided us with organs fitted to frame articulate ſounds, and given us alſo a capacity of uſing thoſe ſounds as ſigns of internal conceptions. Hence ſpring words and language: for, having once pitched upon any ſound to ſtand as the mark of an idea in the mind, cuſtom by degrees eſtabliſhes ſuch a connection between them, that the appearance of the idea in the underſtanding always brings to our remembrance the ſound or name by which it is expreſſed; as in like manner the hearing of the ſound never fails to excite the idea for which it is made to ſtand. And thus it is eaſy to conceive how a man may record his own thoughts, and bring them again into view in any ſucceeding period of life. For this connection being once ſettled, as the ſame ſounds will always ſerve to excite the ſame ideas; if he can but contrive to regiſter his words in the order and diſpoſition in which the preſent train of his thoughts preſent themſelves to his imagination, it is evident he will be able to recal theſe thoughts at pleaſure, and that too in the very manner of their firſt appearance. Accordingly we find, that the inventions of writing and printing, by enabling us to fix and perpetuate ſuch periſhable things as ſounds, have alſo furniſhed us with the means of giving a kind of permanency to the tranſactions of the mind, inſomuch that they may be in the ſame manner ſubjected to our review as any other objects of nature.

2 And of the mutual communication of knowledge from one man to another.

II. But, beſides the ability of recording our own thoughts, there is this farther advantage in the uſe of external ſigns, that they enable us to communicate our thoughts to *others*, and alſo to receive information of what paſſes in *their* breaſts. For any number of men, having agreed to eſtabliſh the ſame ſounds as ſigns of the ſame ideas, it is apparent that the repetition of theſe ſounds muſt excite the like perceptions in each, and create a perfect correſpondence of thoughts. When, for inſtance, any train of ideas ſucceed one another in my mind, if the names by which I am wont to expreſs them have been annexed by thoſe with whom I converſe to the very ſame ſet of ideas, nothing is more evident, than that, by repeating thoſe names according to the tenor of my preſent conceptions, I ſhall raiſe in their minds the ſame courſe of thought as has taken poſſeſſion of my own. For by barely attending to what paſſes within themſelves upon hearing the ſounds which I repeat, they will alſo become acquainted with the ideas in my underſtanding, and have them in a manner laid before their view. So that we here clearly perceive how a man may communicate his ſentiments, knowledge, and diſcoveries to others, if the language in which he converſes, be extenſive enough to mark all the ideas and tranſactions of his mind. But as this is not always the caſe, and men are often obliged to invent terms of their own to expreſs new views and conceptions of things; it may be aſked, how in theſe circumſtances we can become acquainted with the thoughts of another, when he makes uſe of words, to which we have never annexed any ideas, and that of courſe can raiſe no perceptions in our minds? In order to unveil this myſtery, and give ſome little inſight into the foundation, growth, and improvement of language, the following obſervations will be found of conſiderable moment.

3 Simple ideas cannot be conveyed into the mind by words, or a deſcription.

III. Firſt, that no word can be to any man the ſign of an idea, till that idea comes to have a real exiſtence in his mind. For names, being only ſo far intelligible as they denote known internal conceptions; where they have none ſuch to anſwer them, there they are plainly ſounds without ſignification, and of courſe convey no inſtruction or knowledge. But no ſooner are the ideas to which they belong raiſed in the underſtanding, than, finding it eaſy to connect them with the eſtabliſhed names, we can join in any agreement of this kind made by others, and thereby enjoy the benefit of their diſcoveries. The firſt thing therefore to be conſidered is, how theſe ideas may be conveyed into the mind; that being there, we may learn to con-

nect

nect them with their appropriated ſounds, and ſo become capable of underſtanding others when they make uſe of theſe ſounds in laying open and communicating their thoughts. Now, to comprehend this diſtinctly, it will be neceſſary to attend to the diviſion of our ideas into ſimple and complex, (ſee METAPHYSICS.) And firſt, as for our ſimple ideas; they can find no admiſſion into the mind, but by the two original fountains of knowledge, ſenſation and reflection. If therefore any of theſe have as yet no being in the underſtanding, it is impoſſible by words or a deſcription to excite them there. A man who had never felt the ſenſation of *heat*, could not be brought to comprehend that ſenſation by any thing we might ſay to explain it. If we could really produce the idea in him, it muſt be by applying the proper object to his ſenſes, and bringing him within the influence of a hot body. When this is done, and experience has taught him the perception to which men have annexed the name *heat*, it then becomes to him the ſign of that idea, and he thenceforth underſtands the meaning of the term, which, before, all the words in this world would not have been ſufficient to convey into his mind. The caſe is the ſame in reſpect of light and colours. A man born blind, and thereby deprived of the only conveyance for the ideas of this claſs, can never be brought to underſtand the names by which they are expreſſed. The reaſon is plain: they ſtand for ideas that have no exiſtence in his mind; and as the organ appropriated to their reception is wanting, all other contrivances are vain, nor can they by any force or deſcription be raiſed in his imagination. But it is quite otherwiſe in our complex notions. For theſe being no more than certain combinations of ſimple ideas, put together in various forms; if the original ideas out of which the collections are made have already got admiſſion into the underſtanding, and the names ſerving to expreſs them are known; it will be eaſy, by enumerating the ſeveral ideas concerned in the compoſition, and marking the order and manner in which they are united, to raiſe any complex conception in the mind. Thus the idea anſwering to the word *rainbow* may be readily excited in the imagination of another who has never ſeen the appearance itſelf, by barely deſcribing the figure, largeneſs, poſition, and order of colours; if we ſuppoſe theſe ſeveral ſimple ideas, with their names, ſufficiently known to him.

4
The names of complex ideas definable, thoſe of ſimple ideas not.

IV. And this leads to a ſecond obſervation upon this ſubject, namely, That words ſtanding for complex ideas are all definable, but thoſe by which we denote ſimple ideas are not: for ſimple ideas being ſecondary perceptions, which have no other entrance into the mind than by ſenſation or reflection, can only be got by experience, from the ſeveral objects of nature, proper to produce thoſe perceptions in us. Words indeed may very well ſerve to remind us of them, if they have already found admiſſion into the underſtanding, and their connection with the eſtabliſhed names is known; but they can never give them their original being and exiſtence there. And hence it is, that when any one aſks the meaning of a word denoting a ſimple idea, we pretend not to explain it to him by a definition, well knowing that to be impoſſible; but, ſuppoſing him already acquainted with the idea, and only ignorant of the name by which it is called, we either mention it to him by ſome other name with which we preſume he knows its connection, or appeal to the object where the idea itſelf is found. Thus, were any one to aſk the meaning of the word *white*, we ſhould tell him it ſtood for the ſame idea as *albus* in Latin, or *blanc* in French; or, if we thought him a ſtranger to theſe languages, we might appeal to an object producing the idea, by *ſaying* it denoted the colour we obſerve in *ſnow* or *milk*. But this is by no means a definition of the word, exciting a new idea in his underſtanding; but merely a contrivance to remind him of a known idea, and teach him its connection with the eſtabliſhed name. For if the ideas after which he inquires have never yet been raiſed in his mind; as ſuppoſe one who had ſeen no other colours than *black* and *white*, ſhould aſk the meaning of the word *ſcarlet*; it is eaſy to perceive, that it would be no more poſſible to make him comprehend it by words, or a definition, than to introduce the ſame perception into the imagination of a man born blind. The only method in this caſe is, to preſent ſome object, by looking at which the perception itſelf may be excited; and thus he will learn both the name and the idea together.

5
Experience and obſervation bring men to an agreement in the names of ſimple ideas.

V. But how comes it to paſs that men agree in the names of their ſimple ideas, ſeeing they cannot view the perceptions in one another's minds, nor make known theſe perceptions by words to others? The effect is produced by experience and obſervation. Thus finding, for inſtance, that the name of *heat* is annexed to that ſenſation which men feel when they approach the fire, I make it alſo the ſign of the ſenſation excited in me by ſuch an approach, nor have any doubt but it denotes the ſame perception in my mind as in theirs. For we are naturally led to imagine, that the ſame objects operate alike upon the organs of the human body, and produce an uniformity of ſenſations. No man fancies, that the idea raiſed in him by the taſte of *ſugar*, and which he calls *ſweetneſs*, differs from that excited in another by the like means; or that *wormwood*, to whoſe reliſh he has given the epithet *bitter*, produces in another the ſenſation which he denotes by the word *ſweet*. Preſuming therefore upon this conformity of perceptions, when they ariſe from the ſame objects, we eaſily agree as to the names of our ſimple ideas: and if at any time, by a more narrow ſcrutiny into things, new ideas of this claſs come in our way, which we chooſe to expreſs by terms of our own invention; theſe names are explained, not by a definition, but by referring to the objects whence the ideas themſelves may be obtained.

6
The conveyance of complex ideas by definitions, a wiſe contrivance in nature;

VI. Being in this manner furniſhed with ſimple ideas, and the names by which they are expreſſed; the meaning of terms that ſtand for complex ideas is eaſily got, becauſe the ideas themſelves anſwering to theſe terms may be conveyed into the mind by definitions. For our complex notions are only certain combinations of ſimple ideas. When therefore theſe are enumerated, and the manner in which they are united into one conception explained, nothing more is wanting to raiſe that conception in the underſtanding; and thus the term denoting it comes of courſe to be underſtood. And here it is worth while to reflect a little upon the wiſe contrivance of nature, in thus furniſhing us with the very apteſt means of communicating our thoughts. For were it not ſo ordered, that

that we could thus convey our complex ideas from one to another by definitions, it would in many caſes be impoſſible to make them known at all. This is apparent in thoſe ideas which are the proper work of the mind. For as they exiſt only in the underſtanding, and have no real objects in nature in conformity to which they are framed; if we could not make them known by deſcription, they muſt lie for ever hid within our own breaſts, and be confined to the narrow acquaintance of a ſingle mind. All the fine ſcenes that ariſe from time to time in the poet's fancy, and by his lively painting give ſuch entertainment to his readers; were he deſtitute of this faculty of laying them open to the view of others by words and deſcription, could not extend their influence beyond his own imagination, or give joy to any but the original inventor.

7 And of great avail towards the improvement of knowledge.

VII. There is this farther advantage in the ability we enjoy of communicating our complex notions by definitions; that as theſe make by far the largeſt claſs of our ideas, and moſt frequently occur in the progreſs and improvement of knowledge, ſo they are by theſe means imparted with the greateſt readineſs, than which nothing would tend more to the increaſe and ſpreading of ſcience: for a definition is ſoon peruſed; and if the terms of it are well underſtood, the idea itſelf finds an eaſy admiſſion into the mind. Whereas in ſimple perceptions, where we are referred to the objects producing them, if theſe cannot be come at, as is ſometimes the caſe, the names by which they are expreſſed muſt remain empty ſounds. But new ideas of this claſs occurring very rarely in the ſciences, they ſeldom create any great obſtruction. It is otherwiſe with our complex notions; for every ſtep we take leading us into new combinations and views of things, it becomes neceſſary to explain theſe to others, before they can be made acquainted with our diſcoveries: and as the manner of definitions is eaſy, requiring no apparatus but that of words, which are always ready, and at hand; hence we can with the leſs difficulty remove ſuch obſtacles as might ariſe from terms of our own invention, when they are made to ſtand for new complex ideas ſuggeſted to the mind by ſome preſent train of thinking. And thus at leaſt we are let into the myſtery hinted at in the beginning of this chapter, *viz.* how we may become acquainted with the thoughts of another, when he makes uſe of words to which we have as yet joined no ideas. The anſwer is obvious from what has been already ſaid. If the terms denote ſimple perceptions, he muſt refer us to theſe objects of nature whence the perceptions themſelves are to be obtained; but, if they ſtand for complex ideas, their meaning may be explained by a *definition.*

Chap. II. *Of Definitions.*

8 Definition defined.

I. A Definition *is the unfolding of ſome conception of the mind, anſwering to the word or term made uſe of as the ſign of it.* Now as, in exhibiting any idea to another, it is neceſſary that the deſcription be ſuch as may excite that preciſe idea in his mind; hence it is plain that definitions, properly ſpeaking are not arbitrary, but confined to the repreſenting of certain determinate ſettled notions, ſuch namely as are annexed by the ſpeaker or writer to the words he uſes. As nevertheleſs it is univerſally allowed that the ſignification of words is perfectly voluntary, and not the effect of any natural and neceſſary connection between them and the ideas for which they ſtand; ſome may perhaps wonder why definitions are not ſo too. In order therefore to unravel this difficulty, and ſhow diſtinctly what is and what is not arbitrary in ſpeech, we muſt carefully diſtinguiſh between the connection of our words and ideas, and the unfolding of the ideas themſelves.

9 The connection between words and ideas, a perfectly voluntary eſtabliſhment.

II. Firſt, as to the connection of our words and ideas; this, it is plain, is a purely arbitrary inſtitution. When, for inſtance, we have in our minds the idea of any particular ſpecies of metals, the calling it by the name *gold* is an effect of the voluntary choice of men ſpeaking the ſame language, and not of any peculiar aptneſs in that ſound to expreſs that idea. Other nations we find make uſe of different ſounds, and with the ſame effect. Thus *aurum* denotes that idea in Latin, and *or* in French; and even the word *gold* itſelf would have as well ſerved to expreſs the idea of that metal which we call *ſilver*, had cuſtom in the beginning eſtabliſhed it.

10 The deſcription of ideas not ſo, but bounded to the repreſentation of that preciſe appearance by which they are diſtinguiſhed among themſelves.

III. But although we are thus entirely at liberty in connecting any idea with any ſound, yet it is quite otherwiſe in unfolding the ideas themſelves. For every idea having a preciſe appearance of its own, by which it is diſtinguiſhed from every other idea; it is manifeſt, that in laying it open to others, we muſt ſtudy ſuch a deſcription as ſhall exhibit that peculiar appearance. When we have formed to ourſelves the idea of a figure bounded by four equal ſides, joined together at right angles, we are at liberty to expreſs that idea by any ſound, and call it either a *ſquare* or a *triangle.* But whichever of theſe names we uſe, ſo long as the idea is the ſame, the deſcription by which we would ſignify it to another muſt be ſo too. Let it be called *ſquare* or *triangle,* it is ſtill a figure having four equal ſides, and all its angles right ones. Hence we clearly ſee what is and what is not arbitrary in the uſe of words. The eſtabliſhing any ſound as the mark of ſome determinate idea in the mind, is the effect of free choice, and a voluntary combination among men: and as different nations make uſe of different ſounds to denote the ſame ideas, hence proceeds all that variety of languages which we meet with in the world. But when a connection between our ideas and words is once ſettled, the unfolding of the idea anſwering to any word, which properly conſtitutes a definition, is by no means an arbitrary thing: for here we are bound to exhibit that preciſe conception which either the uſe of language, or our own particular choice, hath annexed to the term we uſe.

11 Cauſes of the obſcurity that has hitherto perplexed the theory of definitions.

IV. And thus it appears, that definitions, conſidered as deſcriptions of ideas in the mind, are ſteady and invariable, being bounded to the repreſentation of theſe preciſe ideas. But then, in the application of definitions to particular names, we are altogether left to our own free choice. Becauſe as the connecting of any idea with any ſound is a perfectly arbitrary inſtitution, the applying the deſcription of that idea to that ſound muſt be ſo too. When therefore logicians tell us that the definition of the name is arbitrary, they mean no more than this; that as different ideas may be connected with any term, according to the good pleaſure of him that uſes it; in like manner may different deſcriptions be applied to the term, ſuitable to the ideas ſo connected. But this connection being ſettled, and the term conſidered as the ſign of ſome fixed idea in the underſtanding, we are no longer left to arbitrary explications, but muſt ſtudy ſuch a deſcription as correſponds with that preciſe idea. Now this alone, according to what has been before laid down, ought to be accounted a definition. What ſeems to have occaſioned no ſmall confuſion in this matter, is, that many explanations of words, where no idea is unfolded, but merely the connection between ſome word and idea aſſerted, have yet been dignified with the name of definitions. Thus, when we ſay that *a clock is an inſtrument by which we meaſure time;* that is by ſome called a definition; and yet it is plain that we are beforehand ſuppoſed to have an idea of this inſtrument, and only taught that the word *clock* ſerves in common language to denote that idea. By this rule all explications of words in our dictionaries will be definitions, nay, the names of even ſimple ideas may be thus defined. *White*, we may ſay, is the colour we obſerve in ſnow or milk: *heat* the ſenſation produced by approaching the fire; and ſo in innumerable other inſtances. But theſe, and all others of the like kind, are by no means definitions, exciting new ideas, in the underſtanding, but merely contrivances to remind us of known ideas, and teach their connection with the eſtabliſhed names.

12
Complex ideas alone capable of that kind of deſcription which goes by the name of a definition.

V. But now in definitions properly ſo called, we firſt conſider the term we uſe, as the ſign of ſome inward conception, either annexed to it by cuſtom, or our own free choice; and then the buſineſs of the definition is to unfold and explicate that idea. As therefore the whole art lies in giving juſt and true copies of our ideas; a definition is then ſaid to be made perfect, when it ſerves diſtinctly to excite the idea deſcribed in the mind of another, even ſuppoſing him before wholly unacquainted with it. This point ſettled, let us next inquire what thoſe ideas are which are capable of being thus unfolded? And in the firſt place it is evident, that all our ſimple ideas are neceſſarily excluded. We have ſeen already that experience alone is to be conſulted here, inſomuch that if either the objects whence they are derived come not in our way, or the avenues appointed by nature for their reception, are wanting, no deſcription is ſufficient to convey them into the mind. But where the underſtanding is already ſupplied with theſe original and primitive conceptions, as they may be united together in an infinity of different forms; ſo may all their ſeveral combinations be diſtinctly laid open, by enumerating the ſimple ideas concerned in the various collections, and tracing the order and manner in which they are linked one to another. Now theſe combinations of ſimple notices conſtitute what we call our complex notions; whence it is evident, that complex ideas, and thoſe alone, admit of that kind of deſcription which goes by the name of a definition.

VI. Definitions, then, are pictures or repreſentations of our ideas; and as theſe repreſentations are then only poſſible when the ideas themſelves are complex, it is obvious to remark, that definitions cannot have place but where we make uſe of terms ſtanding for ſuch complex ideas. But our complex ideas, being as we have ſaid, nothing more than different combinations of ſimple ideas; we then know and comprehend them perfectly, when we know the ſeveral ſimple ideas of which they conſiſt, and can ſo put them together in our minds as may be neceſſary towards the framing of that peculiar connection which gives every idea its diſtinct and proper appearance.

13
Two things required in a definition, to enumerate the ideas and explain the manner of their combinations.

VII. Two things are therefore required in every definition: firſt, That all the original ideas, out of which the complex one is formed, be diſtinctly enumerated; and, ſecondly, That the order and manner of combining them into one conception be clearly explained. Where a definition has theſe requiſites, nothing is wanting to its perfection; becauſe every one who reads it and underſtands the terms, ſeeing at once what ideas he is to join together, and alſo in what manner, can at pleaſure form in his own mind the complex conception anſwering to the term defined. Let us, for inſtance, ſuppoſe the word *ſquare* to ſtand for that idea by which we repreſent to ourſelves a figure whoſe ſides ſubtend quadrants of a circumſcribed circle. The parts of this idea are the ſides bounding the figure. Theſe muſt be four in number, and all equal among themſelves, becauſe they are each to ſubtend a fourth part of the ſame circle. But, beſides theſe component parts, we muſt alſo take notice of the manner of putting them together, if we would exhibit the preciſe idea for which the word *ſquare* here ſtands For four equal right lines, any-how joined, will not ſubtend quadrants of a circumſcribed circle. A figure with this property muſt have its ſides ſtanding alſo at right angles. Taking in therefore this laſt conſideration reſpecting the manner of combining the parts, the idea is fully deſcribed, and the definition thereby rendered complete. For a figure bounded by four equal ſides, joined together at right angles, has the property required; and is moreover the only right lined figure to which that property belongs.

14
How we are to proceed to arrive at juſt and adequate definitions.

VIII. It will now be obvious to every one, in what manner we ought to proceed, in order to arrive at juſt and adequate definitions. Firſt, we are to take an exact view of the idea to be deſcribed, trace it to its original principles, and mark the ſeveral ſimple perceptions that enter into the compoſition of it. Secondly, we are to conſider the particular manner in which theſe elementary ideas are combined, in order to the forming of that preciſe conception for which the term we make uſe of ſtands. When this is done, and the idea wholly unravelled, we have nothing more to do than fairly tranſcribe the appearance it makes to our own minds. Such a deſcription, by diſtinctly exhibiting the order and number of our primitive conceptions, cannot fail to excite at the ſame time in the mind of every one that reads it, the complex idea reſulting from them; and therefore attains the true and proper end of a definition.

CHAP. III. *Of the Compoſition and Reſolutions of our Ideas, and the Rules of Definition thence ariſing.*

I. The rule laid down in the foregoing chapter is general; extending to all poſſible caſes: and is indeed that to which alone we can have recourſe, where any

15 In compounding our ideas we proceed by a ſucceſſive gradation.

doubt or difficulty ariſes. It is not, however, neceſſary that we ſhould practiſe it in every particular inſtance. Many of our ideas are extremely complicated, inſomuch that to enumerate all the ſimple perceptions out of which they are formed, would be a very troubleſome and tedious work. For this reaſon logicians have eſtabliſhed certain compendious rules of defining, of which it may not be amiſs here to give ſome account. But in order to the better underſtanding of what follows, it will be neceſſary to obſerve, that there is a certain gradation in the compoſition of our ideas. The mind of man is very limited in its views, and cannot take in a great number of objects at once. We are therefore fain to proceed by ſteps, and make our firſt advances ſubſervient to thoſe which follow. Thus, in forming our complex notions, we begin at firſt with but a few ſimple ideas, ſuch as we can manage with eaſe, and unite them together into one conception. When we are provided with a ſufficient ſtock of theſe, and have by habit and uſe rendered them familiar to our minds, they become the component parts of other ideas ſtill more complicated, and form what we may call a ſecond order of compound notions. This proceſs, as is evident, may be continued to any degree of compoſition we pleaſe, mounting from one ſtage to another, and enlarging the number of combinations.

16 Hence ideas of this claſs beſt comprehended, when we advance gradually through all the ſeveral orders.

II. But now in a ſeries of this kind, whoever would acquaint himſelf perfectly with the laſt and higheſt order of ideas, finds it much the moſt expedient method to proceed gradually through all the intermediate ſteps. For, were he to take any very compound idea to pieces, and, without regard to the ſeveral claſſes of ſimple perceptions that have already been formed into diſtinct combinations, break it at once into its original principles the number would be ſo great as perfectly to confound the imagination, and overcome the utmoſt reach and capacity of the mind. When we ſee a prodigious multitude of men jumbled together in crowds, without order or any regular poſition, we find it impoſſible to arrive at an exact knowledge of their number. But if they are formed into ſeparate battalions, and ſo ſtationed as to fall within the leiſure ſurvey of the eye: by viewing them ſucceſſively and in order, we come to an eaſy and certain determination. It is the ſame in our complex ideas. When the original perceptions, out of which they are framed, are very numerous, it is not enough that we take a view of them in looſe and ſcattered bodies; we muſt form them into diſtinct claſſes, and unite theſe claſſes in a juſt and orderly manner, before we can arrive at a true knowledge of the compound notices reſulting from them.

17 Our definitions ſhould keep pace with our ideas, and obſerve a like gradation.

III. This gradual progreſs of the mind to its compound notions, through a variety of intermediate ſteps plainly points out the manner of conducting the definitions by which theſe notions are conveyed into the minds of others. For as the ſeries begins with ſimple and eaſy combinations, and advances through a ſucceſſion of different orders, riſing one above another in the degree of compoſition, it is evident, that, in a train of definitions expreſſing theſe ideas, a like gradation is to be obſerved. Thus the complex ideas of the loweſt order can no otherwiſe be deſcribed than by enumerating the ſimple ideas out of which they are made, and explaining the manner of their union. But then in the ſecond, or any other ſucceeding order, as they are formed out of thoſe gradual combinations, and conſtitute the inferior claſſes, it is not neceſſary, in deſcribing them to mention one by one all the ſimple ideas of which they conſiſt. They may be more diſtinctly and briefly unfolded, by enumerating the compound ideas of a lower order, from whoſe union they reſult, and which are all ſuppoſed to be already known in conſequence of previous definitions. Here then it is that the logical method of defining takes place; which, that it may be the better underſtood, we ſhall explain ſomewhat more particularly the ſeveral ſteps and gradations of the mind in compounding its ideas, and thence deduce that peculiar form of a definition which logicians have though fit to eſtabliſh.

18 The ſteps by which the mind proceeds from particular to general ideas.

IV. All the ideas we receive from the ſeveral objects of nature that ſurround us, repreſent diſtinct individuals. Theſe individuals, when compared together, are found in certain particulars to reſemble each other. Hence, by collecting the reſembling particulars into one conception, we form the notion of a *ſpecies*. And here let it be obſerved, that this laſt idea is leſs complicated than that by which we repreſent any of the particular objects contained under it. For the idea of the ſpecies excludes the peculiarities of the ſeveral individuals, and retains only ſuch properties as are common to them all. Again, by comparing ſeveral ſpecies together, and obſerving their reſemblance, we form the idea of a *genus*; where, in the ſame manner as before, the compoſition is leſſened, becauſe we leave out what is peculiar to the ſeveral ſpecies compared, and retain only the particulars wherein they agree. It is eaſy to conceive the mind proceeding thus from one ſtep to another and advancing through its ſeveral claſſes of general notions, until at laſt it comes to the higheſt genus of all, denoted by the word *being*, where the bare idea of exiſtence is only concerned.

19 The conduct of the mind in compounding its ideas, as it advances thro' the different orders of perception.

V. In this procedure we ſee the mind unravelling a complex idea, and tracing it in the aſcending ſcale, from greater or leſs degrees of compoſition, until it terminates in one ſimple perception. If now we take the ſeries the contrary way, and, beginning with the laſt or higheſt genus, carry our view downwards, through all the inferior genera and ſpecies, quite to the individuals, we ſhall thereby arrive at a diſtinct apprehenſion of the conduct of the underſtanding in compounding ideas. For in the ſeveral claſſes of our preceptions, the higheſt in the ſcale is for the moſt part made up of but a few ſimple ideas, ſuch as the mind can take in and ſurvey with eaſe. This firſt general notion, when branched out into the different ſubdiviſions contained under it, has in every one of them ſomething peculiar, by which they are diſtinguiſhed among themſelves; inſomuch that, in deſcending from the genus to the ſpecies, we always ſuperadd ſome new idea, and thereby increaſe the degree of compoſition. Thus the idea denoted by the word *figure* is of a very general nature, and compoſed of but few ſimple perceptions, as implying no more than ſpace every where bounded. But if we deſcend farther, and conſider the boundaries of this ſpace, as that they may be either lines or ſurface, we fall into the ſeveral ſpecies of figure. For where the ſpace is bounded by one or more ſurfaces, we give it the name

name of a *ſolid figure*; but where the boundaries are lines, it is called a *plain figure* (A).

20
The idea of the ſpecies found by ſuperadding the ſpecific difference to the genus.

VI. In this view of things it is evident, that the ſpecies is formed by ſuperadding a new idea to the genus. Here, for inſtance, the genus is circumſcribed ſpace. If now to this we ſuperadd the idea of a circumſcription by lines, we frame the notion of that ſpecies of figures which are called *plain*; but if we conceive the circumſcription to be by ſurfaces, we have the ſpecies of ſolid figures. This ſuperadded idea is called the *ſpecific difference*, not only as it ſerves to divide the ſpecies from the genus, but becauſe, being different in all the ſeveral ſubdiviſions, we thereby alſo diſtinguiſh the ſpecies one from another. And as it is likewiſe that conception, which, by being joined to the general idea, completes the notion of the ſpecies; hence it is plain, that the genus and ſpecific difference are to be conſidered as the proper and conſtituent parts of the ſpecies. If we trace the progreſs of the mind ſtill farther, and obſerve it advancing through the inferior ſpecies, we ſhall find its manner of proceeding to be always the ſame. For every lower

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(A) This account of the compoſition and reſolution of our ideas is agreeable to the common doctrine of logicians on the ſubject. Into the truth of the doctrine itſelf we ſhall inquire afterwards under the article METAPHYSICS: but to prevent miſtakes, it may be proper to obſerve here, that though every writer of logic has treated largely of *general* and *ſpecific ideas*, there is in reality nothing *general* in the matter but the *terms of language*. When we utter, for inſtance, the word *triangle*, that *general term* does not, as has been often ſaid, ſuggeſt to the mind the *general idea* of a triangle, which is neither *oblique* nor *rectangle*, neither *equilateral* nor *ſcalenon*, &c. for *ſuch* a triangle, as it cannot *exiſt* in *nature*, cannot be *conceived* in *idea*. In like manner, the *general term Virtue* does not excite a general *idea* of *virtue*, which is neither *prudence*, nor *temperance*, nor *fortitude*, nor *juſtice*, nor *charity*, &c. for that which is *diſtinct* from *all theſe* is not *virtue*. What then is the import of ſuch *general terms*? The anſwer is obvious: They denote *claſſes of objects*; and are never uſed without ſome word of limitation, but when ſomething that has no dependence upon the *particular qualities*, which diſtinguiſh the individuals from each other, is affirmed or denied of the whole claſs. Thus we may affirm, that the *three angles of a plain triangle are equal to two right angles*: and this propoſition is demonſtrably true, *not* of a triangle, which is neither *oblique* nor *rectangle*, neither *equilateral* nor *ſcalenon*, for ſuch a triangle never was conceived; but of *all theſe* triangles equally, as the truth of the propoſition and the progreſs of the demonſtration has no dependence upon the *peculiarities* which *diſtinguiſh* theſe triangles from one another. Again, when we ſay that *a man of virtue will be rewarded by God*, we do not mean by the word *virtue* a *general idea* making part of each of the complex and more *particular* ideas of *prudence*, *fortitude*, *juſtice*, &c. and at the ſame time *different* from them all; but we affirm, that the man who practiſes *any* or *all* of theſe virtues, according as he has opportunity, will be rewarded by God.

The hiſtory of our ideas is ſhortly this:—That act of the mind, if it may be called an *act*, which makes known an *external object*, is termed PERCEPTION. That act of the mind which makes known an *internal object*, is termed CONSCIOUSNESS. Objects once perceived may be recalled to the mind by the power of *memory*; and when they are ſo recalled, we have a perception of them in all reſpects ſimilar to the original perception, only leſs diſtinct; we fancy *ourſelves* in the *ſame place*, and the *object perceived* attended by the *ſame circumſtances*. This indiſtinct *ſecondary perception* of an object is termed an IDEA; and therefore the preciſe and accurate definition of an *idea*, in contradiſtinction to an *original perception*, is "that perception of a real object which is raiſed in the mind by the power of memory." Now all our *original perceptions* being of *particular objects*, it is obvious that our *ideas*, which are only thoſe perceptions recalled, muſt be of *particular objects likewiſe*, and that no man can have an *idea* of a thing of which the *real exiſtence* is contradictory and impoſſible. But the *general* and *ſpecific ideas* of logicians, are ideas of *nothing which exiſts*, or *which can poſſibly exiſt*. They are acquired, we are told, by *abſtraction*, in the following manner. Among a number of individuals we perceive certain qualities the ſame in all, whilſt in each individual there are other qualities which have nothing ſimilar to them in any other individual: now the mind, it is ſaid, has a power of abſtracting the *particular qualities* of *each individual* from *thoſe* which are *common to the whole*, and of theſe laſt forming a *general idea* of the whole claſs. Thus all men have nearly the *ſame form*; and they have each *ſome ſtature* and *ſome colour*, though there are not perhaps two individuals who have *preciſely the ſame ſtature* and the *ſame colour*. Now, ſay the advocates for general ideas, if we *abſtract* what is *peculiar* to *each individual*, and retain what is *common* to the *whole race*, we have the *general idea* ſignified by the word *man*. That is, if we conceive a being in human ſhape, which is of *ſtature* and *colour*, but neither *tall* nor *ſhort*, neither *white* nor *black*, nor *red* nor *brown*, nor *any other colour which we ever ſaw*, we have the *general idea* of *humanity*, and underſtand the meaning of the *word man*! Surely no perſon who is not the ſlave of prejudice will pretend that he can frame ſuch an idea as this—the idea of an object which cannot poſſibly exiſt in nature.

By this we do not mean to affirm, that we cannot frame ideas of ſuch objects as have *no real* exiſtence; for it is as eaſy to imagine a man with *ten heads* as *with one*, becauſe there is nothing contradictory between *ten heads* and *one body*. But *figure*, which is ſaid to be ſpace bounded *neither by lines nor ſuperficies*; *colour* which is neither *red* nor *white*, nor *blue* nor *black*, &c.; and *animal*, which is neither *man*, *beaſt*, *bird*, nor *inſect*; are impoſſible in nature, and inconceivable in idea. There is, however, no harm in ſtill retaining the phraſe *general idea*, provided he who uſes it takes care to let it be known, that by theſe words he means not any *abſtract* and *contradictory idea*, but merely a *claſs* of *real objects*. The phraſe may at times prevent much circumlocution; for which reaſon we have retained the uſe of it in the text.

ſpecies is formed by ſuperadding ſome new idea to the ſpecies next above it; inſomuch that in this deſcending ſcale of our perceptions, the underſtanding paſſes through different orders of complex notions, which become more and more complicated at every ſtep it takes. Let us reſume here, for inſtance, the ſpecies of plain figures. They imply no more than ſpace bounded by lines. But if we take in an additional conſideration of the nature of theſe lines, as whether they are *right* or *curves*, we fall into the ſubdiviſions of plain figure, diſtinguiſhed by the names of *rectilinear*, *curvilinear*, and *mixtilinear*.

21 And in all the inferior ſpecies, by ſuperadding the ſpecific difference to the neareſt genus.

VII. And here we are to obſerve, that though plain figures, when conſidered as one of thoſe branches that come under the notion of figure in general, take the name of a ſpecies; yet compared with the claſſes of curvilinear, rectilinear, and mixtilinear, into which they themſelves may be divided, they really become a genus, of which the before mentioned ſubdiviſions conſtitute the ſeveral ſpecies. Theſe ſpecies, in the ſame manner as in the caſe of plain and ſolid figures, conſiſt of the genus and ſpecific difference as their conſtituent parts. For in the curvilinear kind, the curvity of the lines bounding the figure makes what is called the *ſpecific difference*; to which if we join the genus, which here is a plain figure or ſpace circumſcribed by lines, we have all that is neceſſary towards completing the notion of this ſpecies. We are only to take notice, that this laſt ſubdiviſion, having two genera above it, *viz.* plain figure, and figure in general; the genus joined with the ſpecific difference, in order to conſtitute the ſpecies of curvilinears, is that which lies neareſt to the ſaid ſpecies. It is the notion of plain figure, and not of figure in general, that, joined with the idea of curvity, makes up the complex conception of curve-lined figures. For in this deſcending ſcale of our ideas, figure in general, plain figures, curve-lined figures, the two firſt are conſidered as general in reſpect of the third; and the ſecond in order, or that which ſtands next to the third, is called the *neareſt genus*. But now as it is this ſecond idea, which, joined with the notion of curvity, forms the ſpecies of curve-lined figures; it is plain, that the third or laſt idea in the ſeries is made up of the neareſt genus and ſpecific difference. This rule holds invariably, however far the ſeries is continued; becauſe, in a train of ideas thus ſucceeding one another, all that precede the laſt are conſidered as ſo many genera in reſpect of that laſt; and the laſt itſelf is always formed by ſuperadding the ſpecific difference to the genus next it.

22 The idea of any individual compoſed of the loweſt ſpecies and numeric difference.

VIII. Here then we have an univerſal deſcription, applicable to all our ideas of whatever kind, from the higheſt genus to the loweſt ſpecies. For taking them, in order downwards from the ſaid general idea, they every where conſiſt of the *genus proximum*, and *differentia ſpecifica*, as logicians love to expreſs themſelves. But when we come to the loweſt ſpecies of all, comprehending under it only individuals, the ſuperaded idea, by which theſe individuals are diſtinguiſhed one from another, no longer takes the name of the ſpecific difference. For here it ſerves not to denote diſtinct ſpecies, but merely a variety of individuals, each of which, having a particular exiſtence of its own, is therefore numerically different from every other of the ſame kind. And hence it is, that in this laſt caſe, logicians chooſe to call the ſuperadded idea by the name of of *numerical difference*; inſomuch that, as the idea of a ſpecies is made up of the neareſt genus and ſpecific difference, ſo the idea of an individual conſiſts of the loweſt ſpecies and numeric difference. Thus the circle is a ſpecies of curve-lined figures, and what we call the *loweſt ſpecies*, as comprehending under it only individuals. Circles in particular are diſtinguiſhed from one another by the length and poſition of their diameters. The length therefore and poſition of the diameter of a circle form what logicians call the *numerical difference*; becauſe, theſe being given, the circle itſelf may be deſcribed, and an individual thereby conſtituted.

23 Definitions to follow one another in train, and paſs thro' the ſame ſucceſſive gradations as our compound ideas.

IX. Thus the mind, in compounding its ideas, begins, we ſee, with the moſt general notions, which, conſiſting of but a few ſimple notices, are eaſily combined and brought together into one conception. Thence it proceeds to the ſpecies comprehended under this general idea, and theſe are formed by joining together the genus and ſpecific difference. And as it often happens, that theſe ſpecies may be ſtill farther ſubdivided, and run on in a long ſeries of continued gradations, producing various orders of compound perceptions; ſo all theſe ſeveral orders are regularly and ſucceſſively formed by annexing in every ſtep the ſpecific difference to the neareſt genus. When by this method of procedure we are come to the loweſt order of all, by joining the ſpecies and numeric difference, we frame the ideas of individuals. And here the ſeries neceſſarily terminates, becauſe it is impoſſible any farther to bound or limit our conceptions. This view of the compoſition of our ideas, repreſenting their conſtituent parts in every ſtep of the progreſſion, naturally points out the true and genuine form of a definition. For as definitions are no more than deſcriptions of the ideas for which the terms defined ſtand; and as ideas are then deſcribed, when we enumerate diſtinctly and in order the parts of which they conſiſt; it is, that by making our definitions follow one another according to the natural train of our conceptions, they will be ſubject to the ſame rules, and keep pace with the ideas they deſcribe.

24 The form of a definition in all the various orders of conception.

X. As therefore the firſt order of our compound notions, or the ideas that conſtitute the higheſt genera in the different ſcales of perception, are formed by uniting together a certain number of ſimple notices; ſo the terms expreſſing theſe genera are defined *by enumerating the ſimple notices ſo combined.* And as the ſpecies comprehended under any genus, or the complex ideas of the ſecond order, ariſe from ſuperadding the ſpecific difference to the ſaid general idea; ſo the definition of the names of the ſpecies is abſolved, in a detail of the ideas of the ſpecific difference, connected with the term of the genus. For the genus having been before defined, the term by which it is expreſſed ſtands for a known idea, and may therefore be introduced into all ſubſequent definitions, in the ſame manner as the names of ſimple perceptions. It will now be ſufficiently obvious, that the definitions of all the ſucceeding orders of compound notions will every where conſiſt of the term of the neareſt genus, joined with an enumeration of the ideas that conſtitute the ſpecific difference; and that the definition of individuals unites the names of the loweſt ſpecies with the terms by which we expreſs the ideas of the numeric difference.

XI. Here then we have the true and proper form of a definition, in all the various orders of conception. This is that method of defining which is commonly called *logical*, and which we ſee is perfect in its kind, inaſmuch as it preſents a full and adequate deſcription of the idea for which the term defined ſtands.

PART. II. OF JUDGEMENT.

CHAP. I. *Of the grounds of Human Judgement.*

25 **Intuition reſpects the relations between our ideas when they are immediately perceivable.**

THE mind being furniſhed with ideas, its next ſtep in the way to knowledge is, the comparing theſe ideas together in order to judge of their agreement or diſagreement. In this joint view of our ideas, if the relation is ſuch as to be immediately diſcoverable by the bare inſpection of the mind, the judgements thence obtained are calleſt *intuitive*, from a word that denotes *to look at*; for in this caſe, a mere attention to the ideas compared ſuffices to let us ſee how far they are connected or disjoined. Thus, *that the Whole is greater than any of its Parts*, is an intuitive judgement; nothing more being required to convince us of its truth, than an attention to the ideas of *whole* and *part*. And this too is the reaſon why we call the act of the mind forming theſe judgements *intuition*; as it is indeed no more than an immediate perception of the agreement or diſagreement of any two ideas.

26 **Experience and teſtimony the ground of judging as to facts.**

II. But here it is to be obſerved, that our knowledge of this kind reſpects only our ideas, and the relations between them; and therefore can ſerve only as a foundation to ſuch reaſonings as are employed in inveſtigating thoſe relations. Now it ſo happens, that many of our judgements are converſant about facts, and the real exiſtence of things, which cannot be traced by the bare contemplation of our ideas. It does not follow, becauſe I have the idea of a circle in my mind, that therefore a figure anſwering to that idea has a real exiſtence in nature. I can form to myſelf the notion of a centaur or golden mountain, but never imagine on that account that either of them exiſts. What then are the grounds of our judgement in relation to facts? *experience* and *teſtimony*. By experience we are informed of the exiſtence of the ſeveral objects which ſurround us, and operate upon our ſenſes. Teſtimony is of a wider extent, and reaches not only to objects beyond the preſent ſphere of our obſervation, but alſo to facts and tranſactions, which being now paſt, and having no longer any exiſtence, could not without this conveyance have fallen under our cognizance.

27 **Three foundations of human judgement, *viz.* 1. Intuition, the ground of ſcientifical knowledge.**

III. Here we have three foundations of human judgment, from which the whole ſyſtem of our knowledge may with eaſe and advantage be derived. Firſt, intuition, which reſpects our ideas themſelves, and their relations; and is the foundation of that ſpecies of reaſoning which we call *demonſtration*. For whatever is deduced from our intuitive perceptions, by a clear and connected ſeries of proofs, is ſaid to be demonſtrated, and produces abſolute certainty in the mind. Hence the knowledge obtained in this manner is what we properly term *ſcience*; becauſe in every ſtep of the procedure it carries its own evidence along with it, and leaves no room for doubt or heſitation. And what is highly worthy of notice; as the truths of this claſs expreſs the relation between our ideas, and the ſame relations muſt ever and invariably ſubſiſt between the ſame ideas, our deductions in the way of ſcience conſtitute what we call *eternal*, *neceſſary*, and *immutable truths*. If it be true that the whole is equal to all its parts, it muſt be ſo unchangeably; becauſe the relation of equality being attached to the ideas themſelves, muſt ever intervene where the ſame ideas are compared. Of this nature are all the truths of natural religion, morality, and mathematics, and in general whatever may be gathered from the bare view and conſideration of our ideas.

28 **2. Experience, the ground of our knowledge of the powers and qualities of bodies.**

IV. The ſecond ground of human judgement is *experience*; from which we infer the exiſtence of thoſe ſubjects that ſurround us, and fall under the immediate notice of our ſenſes. When we ſee the ſun, or caſt our eyes towards a building, we not only have perceptions of theſe objects within ourſelves, but aſcribe to them a real exiſtence out of the mind. It is alſo by the information of the ſenſes that we judge of the qualities of bodies; as when we ſay that *ſnow is white*, *fire hot*, or *ſteel hard*. For as we are wholly unacquainted with the internal ſtructure and conſtitution of the bodies that produce theſe ſenſations in us, nay, and are unable to trace any connection between that ſtructure and the ſenſations themſelves, it is evident, that we build our judgements, altogether upon obſervation, aſcribing to bodies ſuch qualities as are anſwerable to the perceptions they excite in us. Not that we ever ſuppoſe the qualities of bodies to be things of the ſame nature with our perceptions; for there is nothing in fire ſimilar to our ſenſation of heat, or in a ſword ſimilar to pain: but that when different bodies excite in our minds ſimilar perceptions, we neceſſarily aſcribe to theſe bodies not only an exiſtence independent of us, but likewiſe ſimilar qualities, of which it is the nature to produce ſimilar perceptions in the human mind. But this is not the only advantage derived from experience; for to that too are we indebted for all our knowledge regarding the coexiſtence of ſenſible qualities in objects, and the operations of bodies one upon another. Ivory, for inſtance, is hard and elaſtic; this we know by experience, and indeed by that alone. For, being altogether ſtrangers to the true nature both of elaſticity and hardneſs, we cannot by the bare contemplation of our ideas determine how far the one neceſſarily implies the other, or whether there may not be a repugnance between them. But when we obſerve them to exiſt both in the ſame object, we are then aſſured from experience that they are not incompatible; and when we alſo find, that a ſtone is hard and not elaſtic, and that air though elaſtic is not hard, we alſo conclude upon the ſame foundation, that the ideas are not neceſſarily conjoined, but

but may exiſt ſeparately in different objects. In like manner with regard to the operations of bodies one upon another, it is evident that our knowledge this way is all derived from obſervation. *Aqua regia* diſſolves gold, as has been found by frequent trial, nor is there any other way of arriving at the diſcovery. Naturaliſts may tell us, if they pleaſe, that the parts of *aqua regia* are of a texture apt to inſinuate between the corpuſcles of gold, and thereby looſen and ſhake them aſſunder. If this is a true account of the matter, it will notwithſtanding be allowed, that our conjecture in regard to the conformation of theſe bodies is deduced from the experiment, and not the experiment from the conjecture. It was not from any previous knowledge of the intimate ſtructure of *aqua regia* and *gold*, and the aptneſs of their parts to act or to be acted upon, that we came by the concluſion abovementioned. The internal conſtitution of bodies is in a manner wholly unknown to us; and could we even ſurmount this difficulty, yet as the ſeparation of the parts of gold implies ſomething like an active force in the *menſtruum*, and we are unable to conceive how it comes to be poſſeſſed of this activity, the effect muſt be owned to be altogether beyond our comprehenſion. But when repeated trials had once confirmed it, inſomuch that it was admitted as an eſtabliſhed truth in natural knowledge, it was then eaſy for men to ſpin out theories of their own invention, and contrive ſuch a ſtructure of parts, both for *gold* and *aqua-regia*, as would beſt ſerve to explain the phenomenon upon the principles of that ſyſtem of philoſophy they had adopted.

V. From what has been ſaid it is evident, that as intuition is the foundation of what we call *ſcientifical* knowledge, ſo is experience of *natural*. For this laſt being wholly taken up with objects of ſenſe, or thoſe bodies that conſtitute the natural world; and their properties, as far as we can diſcover them being to be traced only by a long and painful ſeries of obſervations; it is apparent, that, in order to improve this branch of knowledge, we muſt betake ourſelves to the method of trial and experiment.

VI. But though experience is what we may term the immediate foundation of natural knowledge, yet with reſpect to particular perſons its influence is very narrow and confined. The bodies that ſurround us are numerous, many of them lie at a great diſtance, and ſome quite beyond our reach. Life is ſo ſhort and ſo crowded with cares, that but little time is left for any ſingle man to employ himſelf in unfolding the myſteries of nature. Hence it is neceſſary to admit many things upon the teſtimony of others, which by this means becomes the foundation of a great part of our knowledge of body. No man doubts of the power of *aqua regia* to diſſolve gold, though perhaps he never himſelf made the experiment. In theſe therefore and ſuch like caſes we judge of the facts and operations of nature upon the mere ground of teſtimony. However, as we can always have recourſe to experience where any doubt or ſcruple ariſes, this is juſtly conſidered as the true foundation of natural philoſophy; being indeed the ultimate ſupport upon which our aſſent reſts, and whereto we appeal when the higheſt degree of evidence is required.

VII. But there are many facts that will not allow of an appeal to the ſenſes; and in this caſe teſtimony is the true and only foundation of our judgments. All human actions of whatever kind, when conſidered as already paſt, are of the nature here deſcribed; becauſe having now no longer any exiſtence, both the facts themſelves, and the circumſtances attending them, can be known only from the relations of ſuch as had ſufficient opportunities of arriving at the truth. *Teſtimony* therefore is juſtly accounted a third ground of human judgment; and as from the other two we have deduced *ſcientifical* and *natural* knowledge, ſo we may from this derive *hiſtorical*; by which we mean not merely a knowledge of the civil tranſactions of ſtates and kingdoms, but of all facts whatſoever, where teſtimony is the ultimate foundation of our belief.

29 3. Teſtimony, the ground of hiſtorical knowledge.

Chap. II. *Of Affirmative and Negative Propoſitions.*

30 The ſubject and predicate of a propoſition explained.

I. While the comparing of our ideas is conſidered merely as an act of the mind, aſſembling them together, and joining or disjoining them according to the reſult of its perceptions, we call it *judgment*; but when our judgments are put into words, they then bear the name of *propoſitions*. A propoſition therefore is a ſentence expreſſing ſome judgment of the mind, whereby two or more ideas are affirmed to agree or diſagree. Now, as our judgments include at leaſt two ideas, one of which is affirmed or denied of the other, ſo muſt a propoſition have terms anſwering to theſe ideas. The idea of which we affirm or deny, and of courſe the term expreſſing that idea, is called the *ſubject* of the propoſition. The idea affirmed or denied, as alſo the term anſwering it, is called the *predicate*. Thus in the propoſition, *God is omnipotent: God* is the ſubject, it being of him that we affirm omnipotence; and *omnipotent* is the predicate, becauſe we affirm the idea expreſſed by that word to belong to God.

31 The copula, &c.

II. But as, in propoſitions, ideas are either joined or disjoined; it is not enough to have terms expreſſing thoſe ideas, unleſs we have alſo ſome words to denote their agreement or diſagreement. That word in a propoſition, which connects two ideas together, is called the *copula*; and if a negative particle be annexed, we thereby underſtand that the ideas are disjoined. The *ſubſtantive verb* is commonly made uſe of for the copula: as in the abovementioned propoſition. *God is omnipotent*; where *is* repreſents the copula, and ſignifies the agreement of the ideas of *God* and *omnipotence*. But if we mean to ſeparate two ideas; then beſides the ſubſtantive verb, we muſt alſo uſe ſome particle of negation, to expreſs this repugnance. The propoſition, *man is not perfect*, may ſerve as an example of this kind; where the notion of *perfection* being removed from the idea of *man*, the negative particle *not* is inſerted after the copula, to ſignify the diſagreement between the ſubject and predicate.

32 Propoſitions ſometimes expreſſed by a ſingle word.

III. Every propoſition neceſſarily conſiſts of theſe three parts: but then it is not alike needful that they be all ſeverally expreſſed in words becauſe the copula is often included in the term of the predicate, as when we ſay, *he ſits*, which imports the ſame as *he is ſitting*. In the Latin language, a ſingle word has often the force of a whole ſentence. Thus *ambulat* is the ſame as *ille eſt ambulans*; *amo*, as *ego ſum amans*; and ſo in-

innumerable other inſtances: by which it appears, that we are not ſo much to regard the number of words in a ſentence, as the ideas they repreſent, and the manner in which they are put together. For whereever two ideas are joined or disjoined in an expreſſion, though but of a ſingle word; it is evident that we have a ſubject, predicate and copula, and of conſequence a complete propoſition.

33
Affirmative and negative propoſitions.

IV. When the mind joins two ideas, we call it an *affirmative* judgment; when it ſeparates them, *a negative*: and as any two ideas compared together muſt neceſſarily either agree or not agree, it is evident that all our judgments fall under theſe two diviſions. Hence likewiſe the propoſitions expreſſing theſe judgments are all either affirmative or negative. An affirmative propoſition connects the predicate with the ſubject, as *a ſtone is heavy*; a negative propoſition ſeparates them, as *God is not the author of evil*. *Affirmation* therefore is the ſame as joining two ideas together, and this is done by means of the copula. *Negation* on the contrary marks a repugnance between the ideas compared; in which caſe a negative particle muſt be called in, to ſhow that the connection included in the copula does not take place.

34
When the negative particle ſerves to disjoin ideas.

V. Hence we ſee the reaſon of the rule commonly laid down by logicians, That, in all negative propoſitions the negation ought to affect the copula. For as the copula, when placed by itſelf, between the ſubject and the predicate, manifeſtly binds them together; it is evident, that in order to render a propoſition negative, the particles of negation muſt enter it in ſuch a manner as to deſtroy this union. In a word, then, only are two ideas disjoined in a propoſition, when the negative particle may be ſo referred to the copula, as to break the affirmation included in it, and undo that connection it would otherwiſe eſtabliſh. When we ſay, for inſtance, *No man is perfect*; take away the negation, and the copula of itſelf plainly unites the ideas in the propoſition. But as this is the very reverſe of what is intended, a negative mark is added, to ſhow that this union does not here take place. The negation, therefore, by deſtroying the effect of the copula, changes the very nature of the propoſition, inſomuch that, inſtead of binding two ideas together, it denotes their ſeparation. On the contrary, in this ſentence, *The man who departs not from an upright behaviour is beloved of God*, the predicate *beloved of God* is evidently affirmed of the ſubject *an upright man* ſo that notwithſtanding the negative particle, the propoſition is ſtill affirmative. The reaſon is plain: the negation here affects not the copula; but, making properly a part of the ſubject, ſerves, with other terms in the ſentence, to form one complex idea, of which the predicate *beloved of God* is directly affirmed.

CHAP. III. *Of Univerſal and Particular Propoſitions.*

35
Diviſion of propoſitions into univerſal and particular.

I. THE next conſiderable diviſion of propoſitions is into *univerſal* and *particular*. Our ideas, according to what has been already obſerved in the Firſt Part, are all ſingular as they enter the mind, and repreſent individual objects. But as by abſtraction we can render them univerſal, ſo as to comprehend a whole claſs of things, and ſometimes ſeveral claſſes at once; hence the terms expreſſing theſe ideas muſt be in like manner univerſal. If therefore we ſuppoſe any general term to become the ſubject of a propoſition, it is evident, that whatever is affirmed of the abſtract idea belonging to that term, may be affirmed of all the individuals to which that idea extends. Thus, when we ſay, *Men are mortal*; we conſider mortality not as confined to one or any number of particular men, but as what may be affirmed without reſtriction of the whole ſpecies. By this means the propoſition becomes as general as the idea which makes the ſubject of it; and indeed derives its univerſality entirely from that idea, being more or leſs ſo according as this may be extended to more or fewer individuals. But it is further to be obſerved of theſe general terms, that they ſometimes enter a propoſition in their full latitude, as in the example given above; and ſometimes appear with a mark of limitation. In this laſt caſe we are given to underſtand, that the predicate agrees not to the whole univerſal idea, but only to a part of it; as in the propoſition, *Some men are wiſe*: For here wiſdom is not affirmed of every particular man, but reſtrained to a few of the human ſpecies (B).

36
Propoſiſitions univerſal where the ſubject is ſo, without a mark of reſtriction.

II. Now from this different appearance of the general idea that conſtitutes the ſubject of any judgement, ariſes the diviſion of propoſitions into *univerſal* and *particular*. An univerſal propoſition is that wherein the ſubject is ſome general term taken in its full latitude; inſomuch that the predicate agrees to all the individuals comprehended under it, if it denotes a proper ſpecies; and to all the ſeveral ſpecies, and their individuals, if it marks an idea of a higher order. The words *all*, *every*, *no*, *none*, &c. are the proper ſigns of this univerſality; and as they ſeldom fail to accompany general truths, ſo they are the moſt obvious criterion whereby to diſtinguiſh them. *All animals have a power of beginning motion*. This is an univerſal propoſition; as we know from the word *all* prefixed to the ſubject *animals*, which denotes that it muſt be taken in its full extent. Hence the power of beginning motion may be affirmed of all the ſeveral ſpecies of animals.

37
Propoſitions partiticular where ſome univerſal ſubject appears with a mark of limitation.

III. A *particular* propoſition has in like manner ſome general term for its ſubject; but with a mark of limitation added, to denote, that the predicate agrees only to ſome of the individuals comprehended under a ſpecies, or to one or more of the ſpecies belonging to any genus and not the whole univerſal idea. Thus, *Some ſtones are heavier than iron*: *Some men have an uncommon ſhare of prudence*. In the laſt of theſe propoſitions, the ſubject *ſome men* implies only a certain number

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(B) See the preceding note, where it is demonſtrated that the *terms* alone, and not the *ideas*, are in reality *general*. The term *man* is equally applicable to every individual of the human race; and therefore, what is affirmed or denied of *men* in general, is affirmed or denied of all the individuals, without regard to their diſcriminating qualities. *Some* is a definite word (ſee GRAMMAR), which is prefixed to the word *man*, limits the ſigfication of that *general term*; and therefore what is affirmed of *ſome men*, is affirmed only of *part* of the race, but that part itſelf is not aſcertained.

ber of individuals, comprehended under a ſingle ſpecies. In the former, where the ſubject is a genus that extends to a great variety of diſtinct claſſes, *ſome ſtones* may not only imply any number of particular ſtones, but alſo ſeveral whole ſpecies of ſtones, inaſmuch as there may be not a few with the property there deſcribed. Hence we ſee, that a propoſition does not ceaſe to be particular by the predicate's agreeing to a whole ſpecies, unleſs that ſpecies, ſingly, and diſtinctly conſidered, makes alſo the ſubject of which we affirm or deny.

38 Singular propoſitions contained under the head particulars.

IV. There is ſtill one ſpecies of propoſitions that remains to be deſcribed, and which the more deſerves our notice, as it is not yet agreed among logicians to which of the two claſſes mentioned above they ought to be referred; namely, *ſingular* propoſitions, or thoſe where the ſubject is an individual. Of this nature are the following: *Sir Iſaac Newton was the inventor of fluxions; This book contains many uſeful truths.* What occaſions ſome difficulty as to the proper rank of theſe propoſitions is, that, the ſubject being taken according to the whole of its extenſion, they ſometimes have the ſame effect in reaſoning as univerſals. But if it be conſidered that they are in truth the moſt limited kind of particular propoſitions, and that no propoſition can with any propriety be called univerſal but where the ſubject is ſome univerſal idea; we ſhall not be long in determining to which claſs they ought to be referred. When we ſay, *Some books contain uſeful truths*; the propoſition is particular, becauſe the general term appears with a mark of reſtriction. If therefore we ſay, *This book contains uſeful truths*; it is evident that the propoſition muſt be ſtill more particular, as the limitation implied in the word *this* is of a more confined nature than in the former caſe.

39 The fourfold diviſion of propoſitions.

V. We ſee, therefore, that all propoſitions are either *affirmative* or *negative*; nor is it leſs evident, that in both caſes they may be *univerſal* or *particular*. Hence ariſes that celebrated fourfold diviſion of them into *univerſal affirmative and univerſal negative, particular affirmative* and *particular negative*, which comprehends indeed all their varieties. The uſe of this method of diſtinguiſhing them will appear more fully afterwards, when we come to treat of reaſoning and ſyllogiſm.

CHAP. IV. *Of abſolute and Conditional Propoſitions.*

40 Diſtinction of qualities into eſſential and accidental.

I. The objects about which we are chiefly converſant in this world, are all of a nature liable to change. What may be affirmed of them at one time, cannot often at another; and it makes no ſmall part of our knowledge to diſtinguiſh rightly theſe variations, and trace the reaſons upon which they depend. For it is obſervable, that amidſt all the viciſſitude of nature, ſome things remain conſtant and invariable; nor even are the changes, to which we ſee others liable, effected but in conſequence of uniform and ſteady laws, which, when known, are ſufficient to direct us in our judgments about them. Hence philoſophers, in diſtinguiſhing the objects of our perception into various claſſes, have been very careful to note, that ſome properties belong eſſentially to the general idea, ſo as not to be ſeparable from it but by deſtroying its very nature; while others are only accidental, and may be affirmed or denied of it in different circumſtances. Thus ſolidity, a yellow colour, and great weight, are conſidered as eſſential qualities of gold; but whether it ſhall exiſt as an uniform conjoined maſs, is not alike neceſſary. We ſee that by a proper menſtruum it may be reduced to a fine powder, and that an intenſe heat will bring it into a ſtate of fuſion.

41 Hence a conſiderable diverſity in our manner of judging.

II. From this diverſity in the ſeveral qualities of things ariſes a conſiderable difference as to the manner of our judging about them. For all ſuch properties as are inſeparable from objects when conſidered as belonging to any genus or ſpecies, are affirmed abſolutely and without reſerve of that general idea. Thus we ſay *Gold is very weighty*; *a ſtone is hard*; *Animals have a power of ſelf motion.* But in the caſe of mutual or accidental qualities, as they depend upon ſome other conſideration diſtinct from the general idea; that alſo muſt be taken into the account, in order to form an accurate judgment. Should we affirm, for inſtance, of ſome ſtones, that they are very ſuſceptible of a rolling motion; the propoſition, while it remains in this general form, cannot with any advantage be introduced into our reaſonings. An aptneſs to receive that mode of motion flows from the figure of the ſtone; which, as it may vary infinitely, our judgment then only becomes applicable and determinate, when the particular figure, of which volubility is a conſequence, is alſo taken into the account. Let us then bring in this other conſideration, and the propoſition will run as follows: *Stones of a ſpherical form are eaſily put into a rolling motion.* Here we ſee the condition upon which the predicate is affirmed, and therefore know in what particular caſes the propoſition may be applied.

42 Which gives riſe to the diviſion of propoſitions into abſolute and conditional.

III. This conſideration of propoſitions reſpecting the manner in which the predicate is affirmed of the ſubject gives riſe to the diviſion of them into *abſolute* and *conditional*. *Abſolute* propoſitions are thoſe wherein we affirm ſome property inſeparable from the idea of the ſubject, and which therefore belongs to it in all poſſible caſes; as, *God is infinitely wiſe*; *Virtue tends to the ultimate happineſs of man.* But where the predicate is not neceſſarily connected with the idea of the ſubject, unleſs upon ſome conſideration diſtinct from that idea, there the propoſition is called *conditional*. The reaſon of the name is taken from the ſuppoſition annexed, which is of the nature of a condition, and may be expreſſed as ſuch, thus: *If a ſtone is expoſed to the rays of the ſun, it will contract ſome degree of heat: If a river runs in a very declining channel, its rapidity will conſtantly increaſe.*

43 The great importance of this diviſion, as it renders propoſitions determinate.

IV. There is not any thing of greater importance in philoſophy than a due attention to this diviſion of propoſitions. If we are careful never to affirm things abſolutely but where the ideas are inſeparably conjoined; and if in our other judgments we diſtinctly mark the conditions which determine the predicate to belong to the ſubject; we ſhall be the leſs liable to miſtake in applying general truths to the particular concerns of human life. It is owing to the exact obſervance of this rule that mathematicians have been ſo happy in their diſcoveries, and that what they demonſtrate of magnitude in general may be applied with eaſe in all obvious occurrences.

V. The truth of it is, particular propoſitions are then known to be true, when we can trace their con-

44 And reduces them from particulars to generals.

nection with univerſals; and it is accordingly the great buſineſs of ſcience to find out general truths that may be applied with ſafety in all obvious inſtances. Now the great advantages ariſing from determining with care the conditions upon which one idea may be affirmed or denied of another is this; that thereby particular propoſitions really become univerſal, may be introduced with certainty into our reaſonings, and ſerve as ſtandards to conduct and regulate our judgements. To illuſtrate this by a familiar inſtance: if we ſay, *Some water acts very forcibly*; the propoſition is particular: and as the conditions on which this forcible action depends are not mentioned, it is as yet uncertain in what caſes it may be applied. Let us then ſupply theſe conditions, and the propoſition will run thus: *Water conveyed in ſufficient quantity along a ſteep deſcent acts very forcibly.* Here we have an univerſal judgment, inaſmuch as the predicate *forcible action* may be aſcribed to all water under the circumſtances mentioned. Nor is it leſs evident that the propoſition in this new form is of eaſy application; and in fact we find that men do apply it in inſtances where the forcible action of water is required: as in corn-mills and many other works of art.

CHAP. V. *of Simple and Compound Propoſitions.*

45 Diviſion of propoſitions into ſimple and compound.

I. HITHERTO we have treated of propoſitions, where only two ideas are compared together. Theſe are in the general called *ſimple;* becauſe, having but one ſubject and one predicate, they are the effect of a ſimple judgment that admits of no ſubdiviſion. But if it ſo happens that ſeveral ideas offer themſelves to our thoughts at once, whereby we are led to affirm the ſame thing of different objects, or different things of the ſame object; the propoſitions expreſſing theſe judgments are called *compound:* becauſe they may be reſolved into as many others as there are ſubjects or predicates in the whole complex determination on the mind. Thus, *God is infinitely wiſe and infinitely powerful.* Here there are two predicates, *infinite wiſdom and infinite power,* both affirmed of the ſame ſubject; and accordingly the propoſition may be reſolved into two others, affirming theſe predicates ſeverally. In like manner in the propoſition, *Neither kings nor people are exempt from death*; the predicate is denied of both ſubjects, and may therefore be ſeparated from them in diſtinct propoſitions. Nor is it leſs evident, that if a complex judgment conſiſts of ſeveral ſubjects and predicates, it may be reſolved into as many ſimple propoſitions as are the number of different ideas compared together. *Riches and honours are apt to elate the mind, and increaſe the number of our deſires.* In this judgment there are two ſubjects and two predicates, and it is at the ſame time apparent that it may be reſolved into four diſtinct propoſitions. *Riches are apt to elate the mind. Riches are apt to increaſe the number of our deſires.* And ſo of honours.

46 The proper notion of a compound propoſition aſcertained

II. Logicians have divided theſe compound propoſitions into a great many different claſſes; but, in our opinion, not with a due regard to their proper definition. Thus *conditionals, cauſals, relatives,* &c. are mentioned as ſo many diſtinct ſpecies of this kind, though in fact they are no more than ſimple propoſitions. To give an inſtance of a conditional; *If a ſtone is expoſed to the rays of the ſun, it will contract ſome degree of heat.* Here we have but one ſubject and one predicate; for the complex expreſſion, *A ſtone expoſed to the rays of the ſun,* conſtitutes the proper ſubject of this propoſition, and is no more than one determined idea. The ſame thing happens in cauſals. *Rehoboam was unhappy becauſe he followed evil counſel.* There is here an appearance of two propoſitions ariſing from the complexity of the expreſſion; but when we come to conſider the matter more nearly, it is evident that we have but a ſingle ſubject and predicate. *The purſuit of evil counſel brought miſery upon Rehoboam.* It is not enough, therefore, to render a propoſition compound, that the ſubject and predicate are complex notions, requiring ſometimes a whole ſentence to expreſs them: for in this caſe the compariſon is ſtill confined to two ideas, and conſtitutes what we call a ſimple judgment. But where there are ſeveral ſubjects or predicates, or both, as the affirmation or negation may be alike extended to them all, the propoſition expreſſing ſuch a judgment is truly a collection of as many ſimple ones as there are different ideas compared. Confining ourſelves therefore to this more ſtrict and juſt notion of compound propoſitions, they are all reducible to two kinds, viz. *copulatives* and *disjunctives.*

48 Compound propoſitions either copulative.

III. A *copulative* propoſition is, where the ſubjects and predicates are ſo linked together, that they may be all ſeverally affirmed or denied one of another. Of this nature are the examples of compound propoſitions given above. *Riches and honours are apt to elate the mind, and increaſe the number of our deſires. Neither kings nor people are exempt from death.* In the firſt of theſe the two predicates may be affirmed ſeverally of each ſubject, whence we have four diſtinct propoſitions. The other furniſhes an example of the negative kind where the ſame predicate, being disjoined from both ſubjects, may be alſo denied of them in ſeparate propoſitions.

48 Or disjunctive.

IV. The other ſpecies of compound propoſitions are thoſe called disjunctives; in which, comparing ſeveral predicates with the ſame ſubject; we affirm that one of them neceſſarily belongs to it, but leave the particular predicate undetermined. If any one, for example, ſays, *This world either exiſts of itſelf, or is the work of ſome all-wiſe and powerful cauſe,* it is evident that one of the two predicates muſt belong to the world; but as the propoſition determines not which, it is therefore of the kind we call *diſjunctive.* Such are the two following: *The ſun either moves round the earth, or is the centre about which the earth revolves. Friendſhip finds men equal, or makes them ſo.* It is the nature of all propoſitions of this claſs, ſuppoſing them to be exact in point of form, that upon determining the particular predicate, the reſt are of courſe to be removed, or if all the predicates but one are removed, that one neceſſarily takes place. Thus in the example given above; if we allow the world to be the work of ſome wiſe and powerful cauſe, we of courſe deny it to be ſelf-exiſtent; or if we deny it to be ſelf-exiſtent, we muſt neceſſarily admit that it was produced by ſome wiſe and powerful cauſe. Now this particular manner of linking the predicates together, ſo that the eſtabliſhing one diſplaces all the reſt; or the excluding all but one neceſſarily eſtabliſhes that one: cannot otherwiſe be affected than by means of *diſ-*

junctive particles. And hence it is that propoſitions of this claſs take their names from theſe particles which make ſo neceſſary a part of them, and indeed conſtitute their very nature conſidered as a diſtinct ſpecies.

CHAP. VI. *Of the Diviſion of Propoſitions into Self-evident and Demonſtrable.*

49 Propoſitions divided into ſelf-evident and demonſtrable.

I. WHEN any propoſition is offered to the view of the mind, if the terms in which it is expreſſed be underſtood; upon comparing the ideas together, the agreement or diſagreement aſſerted is either immediately perceived or found to lie beyond the preſent reach of the underſtanding. In the firſt caſe the propoſition is ſaid to be *ſelf-evident*, and admits not of any proof, becauſe a bare attention to the ideas themſelves produces full conviction and certainty; nor is it poſſible to call in any thing more evident by way of confirmation. But where the connection or repugnance comes not ſo readily under the inſpection of the mind, there we muſt have recourſe to reaſoning; and if by a clear ſeries of proofs we can make out the truth propoſed, inſomuch that ſelf-evidence ſhall accompany every ſtep of the procedure, we are then able to demonſtrate what we aſſert, and the propoſition itſelf is ſaid to be *demonſtrable*. When we affirm, for inſtance,'*that it is impoſſible for the ſame thing to be and not to be;* whoever underſtands the terms made uſe of perceives at firſt glance the truth of what is aſſerted, nor can he by any efforts bring himſelf to believe the contrary. The propoſition therefore is *ſelf-evident*, and ſuch that it is impoſſible by reaſoning to make it plainer; becauſe there is no truth more obvious or better known, from which as a conſequence it may be deduced. But if we ſay, *This world had a beginning*; the aſſertion is indeed equally true, but ſhines not forth with the ſame degree of evidence. We find great difficulty in conceiving how the world could be made out of nothing: and are not brought to a free and full conſent, until by reaſoning we arrive at a clear view of the abſurdity involved in the contrary ſuppoſition. Hence this propoſition is of the kind we call *demonſtrable*, inaſmuch as its truth is not immmediately perceived by the mind, but yet may be made appear by means of others more known and obvious, whence it follows as an unavoidable conſequence.

II. From what has been ſaid, it appears, that reaſoning is employed only about demonſtrable propoſitions, and that our intuitive and ſelf-evident perceptions are the ultimate foundation on which it reſts.

50 Self evident truths the firſt principles of reaſoning.

III. Self-evident propoſitions furniſh the firſt principles of reaſoning; and it is certain, that if in our reſearches we employ only ſuch principles as have this character of ſelf-evidence, and apply them according to the rules to be afterwards explained, we ſhall be in no danger of error in advancing from one diſcovery to another. For this we may appeal to the writings of the mathematicians, which being conducted by the expreſs model here mentioned, are an inconteſtable proof of the firmneſs and ſtability of human knowledge, when built upon ſo ſure a foundation. For not only have the propoſitions of this ſcience ſtood the teſt of ages; but are found attended with that invincible evidence, as forces the aſſent of all who duly conſider the proofs upon which they are eſtabliſhed. Since the mathematicians are univerſally allowed to have hit upon the right method of arriving at unknown truths, ſince they have been the happieſt in the choice as well as the application of their principles, it may not be amiſs to explain here their method of ſtating ſelf-evident propoſitions, and applying them to the purpoſes of demonſtration.

51 Definitions a great help to clearneſs and evidence in knowledge.

IV. Firſt then it is to be obſerved, that they have been very careful in aſcertaining their ideas, and fixing the ſignification of their terms. For this purpoſe they begin with *definitions*, in which the meaning of their words is ſo diſtinctly explained, that they cannot fail to excite in the mind of an attentive reader the very ſame ideas as are annexed to them by the writer. And indeed the clearneſs and irreſiſtible evidence of mathematical knowledge is owing to nothing ſo much as this care in laying the foundation. Where the relation between any two ideas is accurately and juſtly traced, it will not be difficult for another to comprehend that relation, if in ſetting himſelf to diſcover it he brings the very ſame ideas into compariſon. But if, on the contrary, he affixes to his words ideas different from thoſe that were in the mind of him who firſt advanced the demonſtration; it is evident, that as the ſame ideas are not compared, the ſame relation cannot ſubſiſt, inſomuch that a propoſition will be rejected as falſe, which, had the terms been rightly underſtood, muſt have appeared inconteſtably true. A ſquare, for inſtance, is a figure bounded by four equal right lines, joined together at right angles. Here the nature of the angles makes no leſs a part of the idea than the equality of the ſides; and many properties demonſtrated of the ſquare flow entirely from its being a rectangular figure. If therefore we ſuppoſe a man, who has formed a partial notion of a ſquare, comprehending only the quality of its ſides, without regard to the angles, reading ſome demonſtration that implies alſo this latter conſideration; it is plain he would reject it as not univerſally true, inaſmuch as it could not be applied where the ſides were joined together at equal angles. For this laſt figure, anſwering ſtill to his idea of a ſquare, would be yet found without the property aſſigned to it in the propoſition. But if he comes afterward to correct his notion, and render his idea complete, he will then readily own the truth and juſtneſs of the demonſtration.

52 Mathematicians, by beginning with them, procure a ready reception to the truths they advance.

V. We ſee, therefore, that nothing contributes ſo much to the improvement and certainty of human knowledge, as the having determinate ideas, and keeping them ſteady and invariable in all our diſcourſes and reaſonings about them. And on this account it is, that mathematicians, as was before obſerved, always begin by defining their terms, and diſtinctly unfolding the notions they are intended to expreſs. Hence ſuch as apply themſelves to theſe ſtudies have exactly the ſame views of things; and, bringing always the very ſame ideas into compariſon, readily diſcern the relations between them. It is likewiſe of importance, in every demonſtration, to expreſs the ſame *idea* invariably by the ſame word. From this practice mathematicians never deviate; and if it be neceſſary in their demonſtrations, where the reader's comprehenſion is *aided* by a diogram, it is much more ſo in all reaſonings about moral or intellectual truths where the ideas

cannot

cannot be repreſented by a diagram. The obſervation of this rule may ſometimes be productive of ill-ſounding periods ; but when *truth* is the object, *ſound* ought to be deſpiſed.

53
The eſtabliſhing of principles, the ſecond ſtep in mathematical knowledge.

VI. When the mathematicians have taken this firſt ſtep, and made known the ideas whoſe relations they intend to inveſtigate ; their next care, is, to lay down ſome ſelf-evident truths, which may ſerve as a foundation for their future reaſonings. And here indeed they proceed with remarkable circumſpection, admitting no principles but what flow immediately from their definitions, and neceſſarily force themſelves upon a mind in any degree attentive to its ideas. Thus a *circle* is a figure formed by a right line moving round ſome fixed point in the ſame plane. The fixed point round which the line is ſuppoſed to move, and where one of its extremities terminates, is called the *centre* of the circle. The other extremity, which is conceived to be carried round until it returns to the point whence it firſt ſet out, deſcribes a curve running into itſelf, and termed the *circumference*. All right lines drawn from the centre to the circumference are called *radii*. From theſe definitions compared, geometricians derive this ſelf-evident truth ; *that the radii of the ſame circle are all equal to one another*.

54
Propoſitions divided into ſpeculative and practical.

VII. We now obſerve, that in all propoſitions we either affirm or deny ſome property of the idea that conſtitutes the ſubject of our judgment, or we maintain that ſomething may be done or effected. The firſt ſort are called *ſpeculative* propoſitions, as in the example mentioned above, the *radii of the ſame circle are all equal one to another*. The others are called *practical*, for a reaſon too obvious to be mentioned ; thus, *that a right line may be drawn from one point to another* is a practical propoſition ; inaſmuch as it expreſſes that ſomething may be done.

55
Hence mathematical principles diſtinguiſhed into axioms and poſtulates.

VIII. From this twofold conſideration of propoſitions ariſes the twofold diviſion of mathematical principles into axioms and poſtulates. By an *axiom* they underſtand any ſelf-evident ſpeculative truth ; as, *That the whole is greater than its parts* : *That things equal to one and the ſame thing are equal to one another*. But a ſelf-evident practical propoſition is what they call a *poſtulate*. Such are thoſe of Euclid ; *that a finite right line may be continued directly forwards* ; *that a circle may be deſcribed about any centre with any diſtance*. And here we are to obſerve that as in an axiom the agreement or diſagreement between the ſubject and predicate muſt come under the immediate inſpection of the mind ; ſo in a poſtulate, not only the poſſibility of the thing aſſerted muſt be evident at firſt view, but alſo the manner in which it may be effected. For where this manner is not of itſelf apparent, the propoſition comes under the notion of the demonſtrable kind, and is treated as ſuch by geometrical writers. Thus, *to draw a right line from one point to another*, is aſſumed by Euclid as a poſtulate, becauſe the manner of doing it is ſo obvious, as to require no previous teaching. But then it is not equally evident, how we are to conſtruct an equilateral triangle. For this reaſon he advances it as a demonſtrable propoſition, lays down rules for the exact performance, and at the ſame time proves, that if theſe rules are followed, the figure will be juſtly deſcribed.

56
And demonſtrable propoſitions into theorems and problems.

IX. This leads us to take notice, that as ſelf-evident truths are diſtinguiſhed into different kinds, according as they are ſpeculative or practical ; ſo is it alſo with demonſtrable propoſitions. A demonſtrable ſpeculative propoſition is by mathematicians called a *theorem*. Such is the famous 47th propoſition of the firſt book of the elements, known by the name of the *Pythagoric theorem* from its ſuppoſed inventor Pythagoras, viz. "that in every right-angled triangle, the ſquare deſcribed upon the ſide ſubtending the right-angle is equal to both the ſquares deſcribed upon the ſides containing the right-angle." On the other hand, a demonſtrable practical propoſition is called a *problem* ; as where Euclid teaches us to deſcribe a ſquare upon a given right-line.

57
Corollaries are obvious deductions from theorems or problems.

X. It may not be amiſs to add, that, beſides the four kinds of propoſitions already mentioned, mathematicians have alſo a fifth, known by the name of *corollaries*. Theſe are uſually ſubjoined to theorems or problems, and differ from them only in this ; that they flow from what is there demonſtrated in ſo obvious a manner as to diſcover their dependence upon the propoſition whence they are deduced, almoſt as ſoon as propoſed. Thus Euclid having demonſtrated, "that in every right-lined triangle all the three angles taken together are equal to two right-angles ;" adds by way of corollary, "that all the three angles of any one triangle taken together are equal to all the three angles of any other triangle taken together :" which is evident at firſt ſight ; becauſe in all caſes they are equal to two right ones, and things equal to one and the ſame thing are equal to one another.

58
Scholia ſerve the purpoſes of annotations or a comment.

XI. The ſcholia of mathematicians are indifferently annexed to definitions, propoſitions, or corollaries ; and anſwer the ſame purpoſes as annotations upon a claſſic author. For in them occaſion is taken to explain whatever may appear intricate and obſcure in a train of reaſoning ; to anſwer objections ; to teach the application and uſes of propoſitions ; to lay open the original and hiſtory of the ſeveral diſcoveries made in the ſcience ; and, in a word, to acquaint us with all ſuch particulars as deſerve to be known, whether conſidered as points of curioſity or profit.

PART III. OF REASONING.

CHAP. I. *Of Reaſoning in general, and the Parts of which it conſiſts.*

59
Remote relations diſcovered by means of intermediate ideas.

IT often happens in comparing ideas together, that their agreement or diſagreement cannot be diſcerned at firſt view, eſpecially if they are of ſuch a nature as not to admit of an exact application one to another. When, for inſtance, we compare two figures of a different make, in order to judge of their equality or inequality, it is plain, that by barely conſidering the figures themſelves, we cannot arrive at an exact determination ; becauſe, by reaſon of their diſagreeing forms, it is impoſſible ſo to put them together, as that their ſeveral parts ſhall mutually coincide. Here then it becomes

comes neceſſary to look out for ſome third idea that will admit of ſuch an application as the preſent caſe requires; wherein if we ſucceed, all difficulties vaniſh, and the relation we are in queſt of may be traced with eaſe. Thus right-lined figures are all reduced to ſquares, by means of which we can meaſure their areas, and determine exactly their agreement or diſagreement in point of magnitude.

60
This manner of arriving at truth termed reaſoning.

II. But how can any third idea ſerve to diſcover a relation between two others? The anſwer is, By being compared ſeverally with theſe others: for ſuch a compariſon enables us to ſee how far the ideas with which this third is compared are connected or disjoined between themſelves. In the example mentioned above of two right-lined figures, if we compare each of them with ſome ſquare whoſe area is known, and find the one exactly equal to it, and the other leſs by a ſquare inch, we immediately conclude that the area of the firſt figure is a ſquare inch greater than that of the ſecond. This manner of determining the relation between any two ideas, by the intervention of ſome third with which they may be compared, is that which we call *reaſoning*; and is indeed the chief inſtrument by which we puſh on our diſcoveries, and enlarge our knowledge. The great art lies in finding out ſuch intermediate ideas, as, when compared with the others in the queſtion, will furniſh evident and known truths; becauſe, as will afterwards appear, it is only by means of them that we arrive at the knowledge of what is hidden and remote.

61
The parts that conſtitute an act of reaſoning and a ſyllogiſm.

III. Hence it appears, that every act of reaſoning neceſſarily includes three diſtinct judgements; two wherein the ideas whoſe relation we want to diſcover are ſeverally compared with the middle idea, and a third wherein they are themſelves connected or disjoined, according to the reſult of that compariſon. Now, as in the ſecond part of logic our judgments, when put into words, were called propoſitions, ſo here in the third part the expreſſions of our reaſonings are termed *ſyllogiſms*. And hence it follows, that as every act of reaſoning implies three ſeveral judgments, ſo every ſyllogiſm muſt include three diſtinct propoſitions. When a reaſoning is thus put into words, and appears in form of a ſyllogiſm, the intermediate idea made uſe of, to diſcover the agreement or diſagreement we ſearch for, is called the *middle term*; and the two ideas themſelves, with which this third is compared go by the name of the *extremes*.

62
Inſtance, man and accountableneſs.

IV. But as theſe things are beſt illuſtrated by examples; let us, for inſtance, ſet ourſelves to inquire *whether men are accountable for their actions*. As the relation between the ideas of *man* and *accountableneſs* comes not within the immediate view of the mind, our firſt care muſt be to find out ſome third idea that will enable us the more eaſily to diſcover and trace it. A very ſmall meaſure of reflection is ſufficient to inform us, that no creature can be accountable for his actions, unleſs we ſuppoſe him capable of diſtinguiſhing the good from the bad; that is, unleſs we ſuppoſe him poſſeſſed of reaſon. Nor is this alone ſufficient. For what would it avail him to know good from bad actions, if he had no freedom of choice, nor could avoid the one and purſue the other? hence it becomes neceſſary to take in both conſiderations in the preſent caſe. It is at the ſame time equally apparent, that wherever there is this ability of diſtinguiſhing good from bad actions, and of purſuing the one and avoiding the other, there alſo a creature is accountable. We have then got a third idea, with which *accountableneſs* is inſeparably connected, viz. *reaſon and liberty*; which are here to be conſidered as making up one complex conception. Let us now take this middle idea, and compare it with the other term in the queſtion, viz. *man*, and we all know by experience that it may be affirmed of him. Having thus by means of the intermediate idea formed two ſeveral judgments, viz. *that man is poſſeſſed of reaſon and liberty*; and *that reaſon and liberty imply accountableneſs*; a third obviouſly and neceſſarily follows, viz. *that man is accountable for his actions*. Here then we have a complete act of reaſoning, in which, according to what has been already obſerved, there are three diſtinct judgments; two that may be ſtyled previous, inaſmuch as they lead to the other, and ariſe from comparing the middle idea with the two ideas in the queſtion: the third is a conſequence of theſe previous acts, and flows from combining the extreme ideas between themſelves. If now we put this reaſoning into words, it exhibits what logicians term a ſyllogiſm; and, when propoſed in due form, runs thus:

“ Every creature poſſeſſed of reaſon and liberty is accountable for his actions.

“ Man is a creature poſſeſſed of reaſon and liberty: Therefore man is accountable for his actions.”

63
Premiſes, concluſion, extremes, middle term.

V. In this ſyllogiſm we may obſerve, that there are three ſeveral propoſitions expreſſing the three judgements implied in the act of reaſoning; and ſo diſpoſed, as to repreſent diſtinctly what paſſes within the mind in tracing the more diſtant relations of its ideas. The two firſt propoſitions anſwer the two previous judgments in reaſoning, and are called the *premiſes*, becauſe they are placed before the other. The third is termed the *concluſion*, as being gained in conſequence of what was aſſerted in the premiſes. We are alſo to remember, that the terms expreſſing the two ideas whoſe relations we enquire after, as here *man* and *accountableneſs*, are in general called the *extremes*; and that the intermediate idea, by means of which the relation is traced, viz. *a creature poſſeſſed of reaſon and liberty*, takes the name of the *middle term*. Hence it follows, that by the *premiſes* of a ſyllogiſm we are always to underſtand the two propoſitions where the middle term is ſeverally compared with the *extremes*; for theſe conſtitute the previous judgments, whence the truth we are in queſt of is by reaſoning deduced. The *concluſion* is that other propoſition, in which the *extremes* themſelves are joined or ſeparated agreeably to what appears upon the above compariſon.

64
Major and minor term, major and minor propoſition.

VI. The concluſion is made up of the extreme terms of the ſyllogiſm; and the extreme, which ſerves as the predicate of the concluſion, goes by the name of the *major term*: the other extreme, which makes the ſubject in the ſame propoſition, is called the *minor term*. From this diſtinction of the extremes ariſes alſo a diſtinction between the premiſes, where theſe extremes are ſeverally compared with the middle term. That propoſition which compares the greater extreme, or the predicate of the concluſion, with the middle term, is called the *major propoſition*: the other, wherein the ſame middle term is compared with the ſubject of the concluſion

concluſion or leſſer extreme, is called the *minor propoſition*. All this is obvious from the ſyllogiſm already given, where the concluſion is, *Man is accountable for his actions*. For here the predicate *accountable for his actions*, being connected with the middle term in the firſt of the two premiſes, *every creature poſſeſſed of reaſon and liberty is accountable for his actions*, gives what we call the *major propoſition*. In the ſecond of the premiſes, *man is a creature poſſeſſed of reaſon and liberty*, we find the leſſer extreme, or ſubject of the concluſion, viz. *man*, connected with the ſame middle term, whence it is known to be the *minor propoſition*. When a ſyllogiſm is propoſed in due form, the major propoſition is always placed firſt, the minor next, and the concluſion laſt.

65 In a ſingle act of reaſoning the premiſes muſt be intuitive truths.

VII. Theſe things premiſed, we may in the general define reaſoning to be an act or operation of the mind, deducing ſome unknown propoſition from other previous ones that are evident and known. Theſe previous propoſitions, in a ſimple act of reaſoning, are only two in number; and it is always required that they be of themſelves apparent to the underſtanding, inſomuch that we aſſent to and perceive the truth of them as ſoon as propoſed. In the ſyllogiſm given above, the premiſes are ſuppoſed to be ſelf evident truths; otherwiſe the concluſion could not be inferred by a ſingle act of reaſoning. If, for inſtance, in the major, *every creature poſſeſſed of reaſon and liberty is accountable for his actions*, the connection between the ſubject and predicate could not be perceived by a bare attention to the ideas themſelves; it is evident that this propoſition would no leſs require a proof than the concluſion deduced from it. In this caſe a new middle term muſt be ſought for, to trace the connection here ſuppoſed; and this of courſe furniſhes another ſyllogiſm, by which having eſtabliſhed the propoſition in queſtion, we are then, and not before, at liberty to uſe it in any ſucceeding train of reaſoning. And ſhould it ſo happen, that in this ſecond eſſay there was ſtill ſome previous propoſition whoſe truth did not appear at firſt ſight, we muſt then have recourſe to a third ſyllogiſm, in order to lay open that truth to the mind; becauſe ſo long as the premiſes remain uncertain, the concluſion built upon them muſt be ſo too. When, by conducting our thoughts in this manner, we at laſt arrive at ſome ſyllogiſm where the previous propoſitions are intuitive truths; the mind then reſts in full ſecurity, as perceiving that the ſeveral concluſions it has paſſed through ſtand upon the immoveable foundation of ſelf-evidence, and when traced to their ſource terminate in it.

66 Reaſoning in the higheſt exerciſe of it, only a concatenation of ſyllogiſms.

VIII. We ſee, therefore, that in order to infer a concluſion by a ſingle act of reaſoning, the premiſes muſt be intuitive propoſitions. Where they are not, previous ſyllogiſms are required; in which caſe reaſoning becomes a complicated act, taking in a variety of ſucceſſive ſteps. This frequently happens in tracing the more remote relation of our ideas; where, many middle terms being called in, the concluſion cannot be made out but in conſequence of a ſeries of ſyllogiſms following one another in train. But although in this concatenation of propoſitions, thoſe that form the premiſes of the laſt ſyllogiſm are often conſiderably removed from ſelf-evidence; yet if we trace the reaſoning backwards, we ſhall find them the concluſions of previous ſyllogiſms, whoſe premiſes approach nearer and nearer to intuition in proportion as we advance, and are found at laſt to terminate in it. And if, after having thus unravelled a demonſtration, we take it the contrary way; and obſerve how the mind, ſetting out with intuitive perceptions, couples them together to form a concluſion; how, by introducing this concluſion into another ſyllogiſm, it ſtill advances one ſtep farther; and ſo proceeds, making every new diſcovery ſubſervient to its future progreſs; we ſhall then perceive clearly, that reaſoning, in the higheſt ſenſe of that faculty, is no more than an orderly combination of thoſe ſimple acts which we have already ſo fully explained.

67 Requires intuitive certainty in every ſtep of the progreſſion.

IX. Thus we ſee, that reaſoning, beginning with firſt principles, riſes gradually from one judgment to another, and connects them in ſuch manner, that every ſtage of the progreſſion brings intuitive certainty along with it. And now at length we may clearly underſtand the definition given above of this diſtinguiſhing faculty of the human mind. Reaſon, we have ſaid, is the ability of deducing unknown truths from principles or propoſitions that are already known. This evidently appears by the foregoing account, where we ſee that no propoſition is admitted into a ſyllogiſm, to ſerve as one of the previous judgments on which the concluſion reſts, unleſs it is itſelf a known and eſtabliſhed truth, whoſe connection with ſelf-evident principles has been already traced.

CHAP. II. *Of the ſeveral kinds of Reaſoning; and firſt, of that by which we determine the Genera and Species of Things.*

68 Reaſoning twofold.

I. All the aims of human reaſon may in the general be reduced to theſe two: 1. To rank things under thoſe univerſal ideas to which they truly belong; and, 2. To aſcribe to them their ſeveral attributes and properties in conſequence of that diſtribution.

69 The firſt kind regards the genera and ſpecies of things.

II. One great aim of human reaſon is to determine the genera and ſpecies of things. We have ſeen in the Firſt Part of this treatiſe, how the mind proceeds in framing general ideas †. We have alſo ſeen in the Second Part, how by means of theſe general ideas we come by univerſal propoſitions. Now as in theſe univerſal propoſitions we affirm ſome property of a genus or ſpecies, it is plain that we cannot apply this property to particular objects till we have firſt determined whether they are comprehended under that general idea of which the property is affirmed. Thus there are certain properties belonging to all *even* numbers, which nevertheleſs cannot be applied to any particular number, until we have firſt diſcovered it to be of the ſpecies expreſſed by that natural name. Hence reaſoning begins with referring things to their ſeveral diviſions and claſſes in the ſcale of our ideas; and as theſe diviſions are all diſtinguiſhed by particular names, we hereby learn to apply the terms expreſſing general conceptions to ſuch particular objects as come under our immediate obſervation.

70 The ſteps by which we arrive at concluſions of this ſort.

III. Now, in order to arrive at theſe concluſions, by which the ſeveral objects of perception are brought under general names, two things are manifeſtly neceſſary. Firſt, that we take a view of the idea itſelf denoted by that general name and carefully attend to the

† See *Foot-note*, p. 195.

the diſtinguiſhing marks which ſerve to characterize it. Secondly, that we compare this idea with the object under conſideration, obſerving diligently wherein they agree or differ. If the idea is found to correſpond with the particular object, we then without heſitation apply the general name ; but if no ſuch correſpondence intervenes, the concluſion muſt neceſſarily take a contrary turn. Let us, for inſtance, take the number *eight*, and conſider by what ſteps we are laid to pronounce it an *even* number. Firſt then, we call to mind the idea ſignified by the expreſſion *an even number*, viz. that it is a number diviſible into two equal parts. We then compare this idea with the number *eight*, and, finding them manifeſtly to agree, ſee at once the neceſſity of admitting the concluſion. Theſe ſeveral judgments therefore transferred into language, and reduced to the form of a ſyllogiſm, appear thus :

“ Every number that may be divided into two
“ equal parts is an *even* number :

“ The number eight may be divided into two equal
“ parts ;

“ Therefore the number *eight* is an *even* number.”

71
Thoſe ſteps always followed, tho' in familiar caſes we do not always attend to them.

IV. Here it may be obſerved, that where the general idea, to which particular objects are referred, is very familiar to the mind, and frequently in view ; this reference, and the application of the general name, ſeem to be made without any apparatus of reaſoning. When we ſee a horſe in the fields, or a dog in the ſtreet, we readily apply the name of the ſpecies ; habit, and a familiar acquaintance with the general idea, ſuggeſting it inſtantaneouſly to the mind. We are not however to imagine on this account that the underſtanding departs from the uſual rules of juſt thinking. A frequent repetition of acts begets a habit ; and habits are attended with a certain promptneſs of execution, that prevents our obſerving the ſeveral ſteps and gradations by which any courſe of action is accompliſhed. But in other inſtances, where we judge not by precontracted habits, as when the general idea is very complex, or leſs familiar to the mind, we always proceed according to the form of reaſoning eſtabliſhed above. A goldſmith, for inſtance, who is in doubt as to any piece of metal, whether it be of the ſpecies called *gold*, firſt examines its properties, and then comparing them with the general idea ſignified by that name, if he finds a perfect correſpondence, no longer heſitates under what claſs of metals to rank it.

72
The great importance of this branch of reaſoning.

V. Nor let it be imagined that our reſearches here, becauſe in appearance bounded to the impoſing of general names upon particular objects, are therefore trivial and of little conſequence. Some of the moſt conſiderable debates among mankind, and ſuch too as nearly regard their lives, intereſt, and happineſs, turn wholly upon this article. Is it not the chief employment of our ſeveral courts of judicature to determine in particular inſtances what is law, juſtice, and equity ? Of what importance is it in many caſes to decide aright whether an action ſhall be termed *murder* or *manſlaughter* ? We ſee then that no leſs than the lives and fortunes of men depend often upon theſe deciſions. The reaſon is plain. Actions, when once referred to a general idea, draw after them all that may be affirmed of that idea ; inſomuch that the determining the ſpecies of actions is all one with determining what proportion of praiſe or diſpraiſe, commendation or blame, *&c.* ought to follow them. For as it is allowed that murder deſerves death ; by bringing any particular action under the head of murder, we of courſe decide the puniſhment due to it.

73
And the exact obſervance of it practiſed by mathematicians.

VI. But the great importance of this branch of reaſoning, and the neceſſity of care and circumſpection in referring particular objects to general ideas, is ſtill farther evident from the practice of the mathematicians. Every one who has read Euclid knows, that he frequently requires us to draw lines through certain points, and according to ſuch and ſuch directions. The figures thence reſulting are often ſquares, parallelograms, or rectangles. Yet Euclid never ſuppoſes this from their bare appearance, but always demonſtrates it upon the ſtricteſt principles of geometry. Nor is the method he takes in any thing different from that deſcribed above. Thus, for inſtance, having defined a ſquare to be a figure bounded by four equal ſides joined together at right angles ; when ſuch a figure ariſes in any conſtruction previous to the demonſtration of a propoſition, yet he never calls it by that name until he has ſhown that its ſides are equal, and all its angles right ones. Now this is apparently the ſame form of reaſoning we have before exhibited in proving *eight* to be an even number.

74
Fixed and invariable ideas, with a ſteady application of names, renders this part of knowledge both eaſy and certain.

VII. Having thus explained the rules by which we are to conduct ourſelves in ranking particular objects under general ideas, and ſhown their conformity to the practice and manner of the mathematicians ; it remains only to obſerve, that the true way of rendering this part of knowledge both eaſy and certain, is, by habituating ourſelves to clear and determinate ideas, and keeping them ſteadily annexed to their reſpective names. For as all our aim is to apply general words aright, if theſe words ſtand for invariable ideas that are perfectly known to the mind, and can be readily diſtinguiſhed upon occaſion, there will be little danger of miſtake or error in our reaſonings. Let us ſuppoſe that, by examining any object, and carrying our attention ſucceſſively from one part to another, we have acquainted ourſelves with the ſeveral particulars obſervable in it. If among theſe we find ſuch as conſtitute ſome general idea, framed and ſettled beforehand by the underſtanding, and diſtinguiſhed by a particular name, the reſemblance thus known and perceived neceſſarily determines the ſpecies of the object, and thereby gives it a right to the name by which that ſpecies is called. Thus four equal ſides, joined together at right angles, make up the notion of a *ſquare*. As this is a fixed and invariable idea, without which the general name cannot be applied : we never call any particular figure a *ſquare* until it appears to have theſe ſeveral conditions ; and contrarily, where ever a figure is found with theſe conditions, it neceſſarily takes the name of a *ſquare*. The ſame will be found to hold in all our other reaſonings of this kind, where nothing can create any difficulty but the want of ſettled ideas. If, for inſtance, we have not determined within ourſelves the preciſe notion denoted by the word *manſlaughter*, it will be impoſſible for us to decide whether any particular action ought to bear that name : becauſe, however nicely we examine the action itſelf, yet, being ſtrangers to the general idea with which it is to be compared, we are utterly

unable

unable to judge of their agreement or diſagreement. But if we take care to remove this obſtacle, and diſtinctly trace the two ideas under conſideration, all difficulties vaniſh, and the reſolution becomes both eaſy and certain.

VIII. Thus we ſee of what importance it is towards the improvement and certainty of human knowledge, that we accuſtom ourſelves to clear and determinate ideas, and a ſteady application of words.

CHAP. III. *Of reaſoning, as it regards the Powers and Properties of Things, and the Relations of our general Ideas.*

75 **The diſtinction of reaſoning, as it regards the ſciences and as it concerns common life.**

I. WE now come to the ſecond great end which men have in view in their reaſonings; namely, the diſcovering and aſcribing to things their ſeveral attributes and properties. And here it will be neceſſary to diſtinguiſh between reaſoning, as it regards the ſciences, and as it concerns common life. In the ſciences, our reaſon is employed chiefly about univerſal truths, it being by them alone that the bounds of human knowledge are enlarged. Hence the diviſion of things into various claſſes, called otherwiſe *genera* and *ſpecies*. For theſe univerſal ideas being ſet up as the repreſentatives of many particular things, whatever is affirmed of them may be alſo affirmed of all the individuals to which they belong. *Murder*, for inſtance is a general idea repreſenting a certain ſpecies of human actions. Reaſon tells us that the puniſhment due to it is *death*. Hence every particular action, coming under the notion of *murder* has the puniſhment of *death*, allotted to it. Here then we apply the general truth to ſome obvious inſtance: and this is what properly conſtitutes the reaſoning of common life. For men, in their ordinary tranſactions and intercourſe one with another, have, for the moſt part, to do only with particular objects. Our friends and relations, their characters and behaviour, the conſtitution of the ſeveral bodies that ſurround us, and the uſes to which they may be applied, are what chiefly engage our attention. In all theſe, we reaſon about particular things; and the whole reſult of our reaſoning is, the applying the general truths of the ſciences in the ordinary tranſactions of human life. When we ſee a viper, we avoid it. Wherever we have occaſion for the forcible action of water to move a body that makes conſiderabe reſiſtance, we take care to convey it in ſuch a manner that it ſhall fall upon the object with impetuoſity. Now all this happens in conſequence of our familiar and ready application of theſe two general truths. *The bite of a viper is mortal. Water, falling upon a body with impetuoſity, acts very forcibly towards ſetting it in motion.* In like maner, if we ſet ourſelves to conſider any particular character, in order to determine the ſhare of praiſe or diſpraiſe that belongs to it, our great concern is to aſcertain exactly the proportion of virtue and vice. The reaſon is obvious. A juſt determination, in all caſes of this kind, depends entirely upon an application of theſe general maxims of morality: *Virtuous actions deſerve praiſe; vicious actions deſerve blame.*

76 **The ſteps by which we proceed in the reaſoning of common life.**

II. Hence it appears that reaſoning, as it regards common life, is no more than the aſcribing the general properties of things to thoſe ſeveral objects with which we are more immediately concerned, according as they are found to be of that particular diviſion or claſs to which the properties belong. The ſteps then by which we proceed are manifeſtly theſe. Firſt, we refer the object under conſideration to ſome general idea or claſs of things. We then recollect the ſeveral attributes of that general idea. And, laſtly, aſcribe all thoſe attributes to the preſent object. Thus, in conſidering the character of *Sempronius*, if we find it to be of the kind called *virtuous*, when we at the ſame time reflect that a virtuous character is deſerving of eſteem, it naturally and obviouſly follows that Sempronius is ſo too. Theſe thoughts put into a *ſyllogiſm*, in order to exhibit the form of reaſoning here required, run thus;

"Every virtuous man is worthy of eſteem.
"*Sempronius* is a virtuous man:
"Therefore *Sempronius* is worthy of eſteem."

77 **The connection and dependence of the two grand branches of reaſoning one upon another.**

III. By this *Syllogiſm* it appears, that before we affirm any thing of a particular object, that object muſt be referred to ſome general idea. Sempronius is pronounced worthy of eſteem only in conſequence of his being a virtuous man, or coming under that general notion. Hence we ſee the neceſſary connection of the various parts of reaſoning, and the dependance they have one upon another. The determining the genera and ſpecies of things is, as we have ſaid, one exerciſe of human reaſon; and here we find that this exerciſe is the firſt in order, and previous to the other, which conſiſts in aſcribing to them their powers, properties, and relations. But when we have taken this previous ſtep, and brought particular objects under general names; as the properties we aſcribe to them are no other than thoſe of the general idea, it is plain that in order to a ſucceſsful progreſs in this part of knowledge, we muſt thoroughly acquaint ourſelves with the ſeveral relations and attributes of theſe our general ideas. When this is done, the other part will be eaſy, and requires ſcarce any labour or thought, as being no more than an application of the general form of reaſoning repreſented in the foregoing ſyllogiſm. Now, as we have already ſufficiently ſhown how we are to proceed in determining the genera and ſpecies of things, which, as we have ſaid, is the previous ſtep to this ſecond branch of human knowledge; all that is further wanting towards a due explanation of it is, to offer ſome conſiderations as to the manner of inveſtigating the general relations of our ideas. This is the higheſt exerciſe of the powers of the underſtanding, and that by means whereof we arrive at the diſcovery of univerſal truths; inſomuch that our deductions in that way conſtitute that particular ſpecies of reaſoning which we have before ſaid regards principally the ſciences.

78 **Two things required to make a good reaſoner.**

IV. But that we may conduct our own thoughts with ſome order and method, we ſhall begin with obſerving, that the relations of our general ideas are of two kinds: either ſuch as immediately diſcover themſelves upon comparing the ideas one with another; or ſuch as, being more remote and diſtant, require art and contrivance to bring them into view. The relations of the firſt kind furniſh us with intuitive and ſelf-evident truths: thoſe of the ſecond are traced by reaſoning, and a due application of intermediate ideas. It is of this laſt kind that we are to ſpeak here, having diſ-

diſpatched what was neceſſary with regard to the other in the Second Part. As, therefore, in tracing the more diſtant relations of things, we muſt always have recourſe to intervening ideas, and are more or leſs ſucceſsful in our reſearches according to our acquaintance with theſe ideas, and ability of applying them; it is evident that, to make a good reaſoner, two things are principally required. *Firſt*, An extenſive knowledge of thoſe intermediate ideas, by means of which things may be compared one with another. *Secondly*, The ſkill and talent of applying them happily in all particular inſtances that come under conſideration.

79 Firſt, an extenſive knowledge of intermediate ideas.

V. In order to our ſucceſsful progreſs in reaſoning, we muſt have an extenſive knowledge of thoſe intermediate ideas by means of which things may be compared one with another. For as it is not every idea that will anſwer the purpoſe of our inquiries, but ſuch only as are peculiarly related to the objects about which we reaſon, ſo as, by a compariſon with them, to furniſh evident and known truths; nothing is more apparent, than that the greater variety of conceptions we can call into view, the more likely we are to find ſome among them that will help us to the truths here required. And, indeed, it is found to hold in experience. that in proportion as we enlarge our views of things, and grow acquainted with a multitude of different objects, the reaſoning faculty gathers ſtrength: for, by extending our ſphere of knowledge, the mind acquires a certain force and penetration, as being accuſtomed to examine the ſeveral appearances of its ideas, and obſerve what light they caſt one upon another.

80 To excel in any one branch of learning, we muſt be in general acquainted with the whole circle of arts and ſciences.

VI. This is the reaſon why, in order to excel remarkably in any one branch of learning, it is neceſſary to have at leaſt a general acquaintance with the whole circle of arts and ſciences. The truth of it is, all the various diviſions of human knowledge are very nearly related among themſelves, and, in innumerable inſtances, ſerve to illuſtrate and ſet off each other. And although it is not to be denied that by an obſtinate application to one branch of ſtudy, a man may make conſiderable progreſs, and acquire ſome degree of eminence in it; yet his views will be always narrow and contracted, and he will want that maſterly diſcernment which not only enables us to purſue our diſcoveries with eaſe, but alſo, in laying them open to others, to ſpread a certain brightneſs around them. But when our reaſoning regards a particular ſcience, it is further neceſſary that we more nearly acquaint ourſelves with whatever relates to that ſcience. A general knowledge is a good preparation, and enables us to proceed with eaſe and expedition in whatever branch of learning we apply to. But then, in the minute and intricate queſtions of any ſcience, we are by no means qualified to reaſon with advantage until we have perfectly maſtered the ſcience to which they belong.

81 Secondly, the ſkill of applying intermediate ideas happily in particular inſtances.

VII. We come now to the ſecond thing required, in order to a ſucceſsful progreſs in reaſoning; namely, the ſkill and talent of applying intermediate ideas happily in all particular inſtances that come under conſideration. And here, rules and precepts are of little ſervice. Uſe and experience are the beſt inſtructors. For, whatever logicians may boaſt of being able to form perfect reaſoners by book and rule, we find by experience, that the ſtudy of their precepts does not always add any great degree of ſtrength to the underſtanding. In ſhort, it is the habit alone of reaſoning that makes a reaſoner. And therefore the true way to acquire this talent is, by being much converſant in thoſe ſciences where the art of reaſoning is allowed to reign in the greateſt perfection. Hence it was that the ancients, who ſo well underſtood the manner of forming the mind, always began with *mathematics*, as the foundation of their philoſophical ſtudies. Here the underſtanding is by degrees habituated to the truth, contracts inſenſibly a certain fondneſs for it, and learns never to yield its aſſent to any propoſition but where the evidence is ſufficient to produce full conviction. For this reaſon *Plato* has called mathematical demonſtrations the *cathartics* or purgatives of the ſoul, as being the proper means to cleanſe it from error, and reſtore that natural exerciſe of its faculties in which juſt thinking conſiſts.

82 The ſtudy of mathematical demonſtrations of great avail in this reſpect.

VIII. If therefore we would form our minds to a habit of reaſoning cloſely and in train, we cannot take any more certain method than the exerciſing ourſelves in mathematical demonſtrations ſo as to contract a kind of familiarity with them. Not that we look upon it as neceſſary that all men ſhould be deep mathematicians, but that, having got the way of reaſoning which that ſtudy neceſſarily brings the mind to, they may be able to transfer it to other parts of knowledge, as they ſhall have occaſion.

83 As alſo of ſuch authors on other ſubjects, as are diſtinguiſhed for ſtrength and juſtneſs of reaſoning.

IX. but although the ſtudy of mathematics be of all others the moſt uſeful to form the mind and give it an early reliſh of truth, yet ought not other parts of philoſophy to be neglected. For there alſo we meet with many opportunities of exerciſing the powers of the underſtanding; and the variety of ſubjects naturally leads us to obſerve all thoſe different turns of thinking that are peculiarly adapted to the ſeveral ideas we examine, and the truth we ſearch after. A mind thus trained acquires a certain maſtery over its own thoughts, inſomuch that it can range and model them at pleaſure, and call ſuch into view as beſt ſuit its preſent deſigns. Now in this the whole art of reaſoning conſiſts; from among a great variety of different ideas to ſingle out thoſe that are moſt proper for the buſineſs in hand, and to lay them together in ſuch order, that from plain and eaſy beginnings, by gentle degrees, and a continued train of evident truths, we may be inſenſibly led on to ſuch diſcoveries, as at our firſt ſetting out appeared beyond the reach of human underſtanding. For this purpoſe, beſides the ſtudy of mathematics before recommended, we ought to apply ourſelves diligently to the reading of ſuch authors as have diſtinguiſhed themſelves for ſtrength of reaſoning and a juſt and accurate manner of thinking. For it is obſervable, that a mind exerciſed and ſeaſoned to truth, ſeldom reſts ſatisfied in a bare contemplation of the arguments offered by others; but will be frequently aſſaying its own ſtrength, and purſuing its diſcoveries upon the plan it is moſt accuſtomed to. Thus we inſenſibly contract a habit of tracing truth from one ſtage to another, and of inveſtigating thoſe general relations and properties which we afterwards aſcribe to particular things, according as we find them compre-

prehend

hended under the abſtract ideas to which the properties belong.

Chap. IV. *Of the Forms of Syllogiſms.*

84 The figures of ſyllogiſms

I. Hitherto we have contented ourſelves with a general notion of ſyllogiſms, and of the parts of which they conſiſt. It is now time to enter a little more particularly into the ſubject, to examine their various forms, and lay open the rules of argumentation proper to each. In the ſyllogiſms mentioned in the foregoing chapters, we may obſerve, that the *middle term* is the ſubject of the *major* propoſition, and the predicate of the *minor*. This diſpoſition, though the moſt natural and obvious, is not however neceſſary; it frequently happening, that the middle term is the ſubject in both the premiſes, or the predicate in both; and ſometimes, directly contrary to its diſpoſition in the foregoing chapters, the predicate in the major, and the ſubject in the minor. Hence the diſtinction of ſyllogiſms into various kinds, called *figures* by logicians. For figure, according to their uſe of the word, is nothing elſe but the order and diſpoſition of the middle term in any ſyllogiſm. And as this diſpoſition is, we ſee, fourfold, ſo the figures of ſyllogiſms thence ariſing are four in number. When the middle term is the ſubject of the major propoſition, and the predicate of the minor, we have what is called the *firſt figure*: As,

“ No work of God is bad:
“ Then atural paſſions and appetites of men are
“ the work of God:
“ Therefore none of them is bad.”

If, on the other hand, it is the predicate of both the premiſes, the ſyllogiſm is ſaid to be the *ſecond figure*: As,

“ Whatever is bad is not the work of God:
“ All the natural paſſions and appetites of men
“ are the work of God:
“ Therefore the natural paſſions and appetites of
“ men are not bad.”

Again, in the *third figure*, the middle term is the ſubject of the two premiſes: As,

“ All Africans are black:
“ All Africans are men:
“ Therefore ſome men are black.”

And laſtly, by making it the predicate of the major, and ſubject of the minor, we obtain ſyllogiſms in the *fourth figure*: As,

“ The only being who ought to be worſhipped is
“ the Creator and Governor of the world:
“ The Creator and Governor of the world is
“ God:
“ Therefore God is the only being who ought to
“ be worſhipped.”

85 The moods of ſyllogiſms.

II. But, beſides this fourfold diſtinction of ſyllogiſms, there is alſo a farther ſubdiviſion of them in every figure, ariſing from the *quantity* and *quality*, as they are called, of the propoſitions. By quantity we mean the conſideration of propoſitions, as univerſal or particular; by quality, as affirmative or negative.

Now as, in all the ſeveral diſpoſitions of the middle term, the propoſitions of which a ſyllogiſm conſiſts may be either univerſal or particular, affirmative or negative; the due determination of theſe, and ſo putting them together as the laws of argumentation require, conſtitute what logicians call the *moods* of ſyllogiſms. Of theſe moods there is a determinate number to every figure, including all the poſſible ways in which propoſitions differing in quantity or quality can be combined, according to any diſpoſition of the middle term, in order to arrive at a juſt concluſion.

The firſt figure has only four legitimate moods. The major propoſition in this figure muſt be univerſal, and the minor affirmative; and it has this property, that it yields concluſions of all kinds, affirmative and negative, univerſal and particular.

The ſecond figure has alſo four legitimate moods. Its major propoſition muſt be univerſal, and one of the premiſes muſt be negative. It yields concluſions both univerſal and particular, but all negative.

The third figure has ſix legitimate moods. Its minor muſt always be affirmative; and it yields concluſions both affirmative and negative, but all particular. ——Theſe are all the figures which were admitted by the inventor of ſyllogiſms; and of which, ſo far as we know, the number of legitimate moods has been aſcertained, and ſeverally demonſtrated. In *every figure* it will be found upon trial; that there are *ſixty-four* different moods of ſyllogiſm; and he who thinks it worth while to conſtruct ſo many in the *fourth* figure, always remembering that the *middle term* in each muſt be the *predicate* of the *major* and the *ſubject* of the *minor* propoſition, will eaſily diſcern what number of theſe moods are *legitimate*, and give true concluſions.

Beſides the rules that are proper to each figure, Ariſtotle has given ſome that are common to all, by which the legitimacy or ſyllogiſms may be tried. Theſe may be reduced to five:——1. There muſt be only *three terms* in a ſyllogiſm: As each term occurs in two of the propoſitions, it muſt be preciſely the *ſame in both*; if it be *not*, the ſyllogiſm is ſaid to have *four terms*, which makes a *vicious* ſyllogiſm. 2. The *middle term* muſt be taken *univerſally* in *one* of the premiſes. 3. Both premiſes muſt *not be particular* propoſitions, nor both *negative*. 4. The *concluſion* muſt be *particular*, if *either* of the *premiſes* be *particular*; and *negative*, if *either* of the *premiſes* be *negative*. 5. No term can be taken *univerſally* in the *concluſion*, if it be *not* taken *univerſally* in the *premiſes*.

For underſtanding the *ſecond* and *fifth* of theſe rules, it is neceſſary to obſerve, that a term is ſaid to be taken *univerſally*, not only when it is the *ſubject* of a *univerſal* propoſition, but alſo when it is the *predicate* of a *negative* propoſition. On the other hand, a term is ſaid to be taken *particularly*, when it is either the *ſubject* of a *particular* or the *predicate* of an *affirmative* propoſition.

86 Foundation of the other diviſion of ſyllogiſms.

III. The diviſion of ſyllogiſms according to mood and figure reſpects thoſe eſpecially which are known by the name of plain ſimple ſyllogiſms; that is, which are bounded to three propoſitions, all ſimple, and where the extremes and middle term are connected, according to the rules laid down above. But as the mind is not tied down to any one preciſe form of reaſoning, but ſometimes makes uſe of more, ſometimes of fewer premiſes, and often takes in compound and conditional propoſitions, it may not be amiſs to take notice of the different forms derived from this ſource, and explain the rules by which the mind conducts itſelf in the uſe of them.

87 Conditional ſyllogiſm.

IV. When in any ſyllogiſm the major is a conditional propoſition, the ſyllogiſm itſelf is termed *conditional*. Thus:

> " If there is a God, he ought to be worſhipped:
> " But there is a God:
> " Therefore he ought to be worſhipped."

In this example, the major, or firſt propoſition, is, we ſee, conditional, and therefore the ſyllogiſm itſelf is alſo of the kind called by that name. And here we are to obſerve, that all conditional propoſitions are made of two diſtinct parts: one expreſſing the condition upon which the predicate agrees or diſagrees with the ſubject, as in this now before us, *if there is a God*; the other joining or disjoining the ſaid predicate and ſubject, as here, *he ought to be worſhipped*. The firſt of theſe parts, or that which implies the condition, is called the *antecedent*; the ſecond, where we join or disjoin the predicate and ſubject, has the name of the *conſequent*.

88 Ground of illation in conditional ſyllogiſms.

V. In all propoſitions of this kind, ſuppoſing them to be exact in point of form, the relation between the antecedent and conſequent muſt ever be true and real; that is the antecedent muſt always contain ſome certain and genuine condition, which neceſſarily implies the conſequent; for otherwiſe the propoſition itſelf will be falſe, and therefore ought not to be admitted into our reaſonings. Hence it follows, that when any conditional propoſition is aſſumed, if we admit the antecedent of that propoſition, we muſt at the ſame time neceſſarily admit the conſequent; but if we reject the conſequent, we are in like manner bound to reject the antecedent. For as the antecedent always expreſſes ſome condition which neceſſarily implies the truth of the conſequent; by admitting the antecedent, we allow of that condition, and therefore ought alſo to admit the conſequent. In like manner, if it appears that the conſequent ought to be rejected, the antecedent evidently muſt be ſo too; becauſe, as was juſt now demonſtrated, the admitting of the antecedent would neceſſarily imply the admiſſion alſo of the conſequent.

89 The two moods of conditional ſyllogiſms.

VI. there are two ways of arguing in *hypothetical* ſyllogiſms, which lead to a certain and unavoidable concluſion. For as the major is always a conditional propoſition, conſiſting of an antecedent and a conſequent; if the minor admits the antecedent, it is plain that the concluſion muſt admit the conſequent. This is called arguing from the admiſſion of the antecedent to the admiſſion of the conſequent, and conſtitutes that mood or ſpecies of hypothetical ſyllogiſms which is diſtinguiſhed in the ſchools by the name of the *modus ponens*, inaſmuch as by it the whole conditional propoſition, both antecedent and conſequent, is eſtabliſhed. Thus:

> " If God is infinitely wiſe, and acts with perfect freedom, he does nothing but what is beſt:
> " But God is infinitely wiſe, and acts with perfect freedom:
> " Therefore he does nothing but what is beſt."

Here we ſee the antecedent or firſt part of the conditional propoſition is eſtabliſhed in the minor, and the conſequent or ſecond part in the concluſion; whence the ſyllogiſm itſelf is an example of the *modus ponens*. But if now we on the contrary ſuppoſe that the minor rejects the conſequent, then it is apparent that the concluſion muſt alſo reject the antecedent. In this caſe we are ſaid to argue from the removal of the conſequent to the removal of the antecedent, and the particular mood or ſpecies of ſyllogiſm thence ariſing is called by logicians the *modus tollens*; becauſe in it both antecedent and conſequent are rejected or taken away, as appears by the following example.

> " If God were not a Being of infinite goodneſs, neither would he conſult the happineſs of his creatures;
> " But God does conſult the happineſs of his creatures:
> " Therefore he is a Being of infinite goodneſs."

90 They include all the legitimate ways of arguing.

VII. Theſe two ſpecies take in the whole claſs of conditional ſyllogiſms, and include all the poſſible ways of arguing that lead to a legitimate concluſion; becauſe we cannot here proceed by a contrary proceſs of reaſoning, that is, from the removal of the antecedent to the removal of the conſequent; or from the eſtabliſhing of the conſequent to the eſtabliſhing of the antecedent. For although the antecedent always expreſſes ſome real condition, which, once admitted, neceſſarily implies the conſequent, yet it does not follow that there is therefore no other condition; and if ſo, then after removing the antecedent, the conſequent may ſtill hold, becauſe of ſome other determination that infers it. When we ſay, *If a ſtone is expoſed ſome time to the rays of the ſun, it will contract a certain degree of heat;* the propoſition is certainly true; and, admitting the antecedent, we muſt alſo admit the conſequent. But as there are other ways by which a ſtone may gather heat, it will not follow, from the ceaſing of the before-mentioned condition, that therefore the conſequent cannot take place. In other words, we cannot argue: *But the ſtone has not been expoſed to the rays of the ſun; therefore neither has it any degree of heat:* Inaſmuch as there are a great many other ways by which heat might have been communicated to it. And if we cannot argue from the removal of the antecedent to the removal of the conſequent, no more can we from the admiſſion of the conſequent to the admiſſion of the antecedent: becauſe, as the conſequent may flow from a great variety of different ſuppoſitions, the allowing of it does not determine the preciſe ſuppoſition, but only that ſome one of them muſt take place. Thus in the foregoing propoſition. *If a ſtone is expoſed ſome time to the rays of the ſun, it will contract a certain degree of heat* admitting the conſequent, viz. *that it has contracted a certain degree of heat*, we are not therefore bound to admit the antecedent, *that it has been ſome time expoſed to the rays of the ſun*; becauſe there are many other cauſes whence the heat may have proceeded. Theſe two ways of arguing, therefore hold not in conditional ſyllogiſm.

91 The manner of arguing in disjunctive ſyllogiſms.

VIII. As from the major's being a conditional propoſition, we obtain the ſpecies of conditional ſyllogiſms; ſo, where it is a disjunctive propoſition, the ſyllogiſm to which it belongs is alſo called *disjunctive*, as in the following example:

> " The world is either ſelf-exiſtent, or the work of ſome finite, or of ſome infinite Being:

“ But it is not ſelf-exiſtent, nor the work of a finite being:
“ Therefore it is the work of an infinite Being.”

Now, a disjunctive propoſition is that, where of ſeveral predicates, we affirm one neceſſarily to belong to the ſubject, to the excluſion of all the reſt, but leave that particular one undetermined. Hence it follows, that as ſoon as we determine the particular predicate, all the reſt are of courſe to be rejected; or if we reject all the predicates but one, that one neceſſarily takes place. When therefore, in a disjunctive ſyllogiſm, the ſeveral predicates are enumerated in the major; if the minor eſtabliſhes any one of theſe predicates, the concluſion ought to remove all the reſt; or if, in the minor, all the predicates but one are removed, the concluſion muſt neceſſarily eſtabliſh that one. Thus, in the disjunctive ſyllogiſm given above, the major affirms one of the three predicates to belong to the earth, *viz. ſelf-exiſtence*, or that it is *the work of a finite*, or that it is *the work of an infinite Being*. Two of theſe predicates are removed in the minor, *viz. ſelf-exiſtence*, and *the work of a finite being*. Hence the concluſion neceſſarily aſcribes to it the third predicate, and affirms that it is *the work of an infinite Being*. If now we give the ſyllogiſm another turn, inſomuch that the minor may eſtabliſh one of the predicates, by affirming the earth to be the *production of an infinite Being*: then the concluſion muſt remove the other two, aſſerting it to be neither *ſelf-exiſtent*, nor *the work of a finite being*. Theſe are the forms of reaſoning in this ſpecies of ſyllogiſms, the juſtneſs of which appears at firſt ſight: and that there can be no other is evident from the very nature of a disjunctive propoſition.

92
Imperfect or mutilated ſyllogiſms.

IX. In the ſeveral kinds of ſyllogiſms hitherto mentioned, we may obſerve, that the parts are complete; that is, the three propoſitions of which they conſiſt are repreſented in form. But it often happens, that ſome one of the premiſes is not only an evident truth, but alſo familiar and in the minds of all men; in which caſe it is uſually omitted, whereby we have an imperfect ſyllogiſm, that ſeems to be made up of only two propoſitions. Should we, for inſtance, argue in this manner:

“ Every man is mortal:
“ Therefore every king is mortal:”

the ſyllogiſm appears to be imperfect, as conſiſting but of two propoſitions. Yet it is really complete; only the minor [*every king is a man*] is omitted: and left to the reader to ſupply, as being a propoſition ſo familiar and evident that it cannot eſcape him.

93
Enthymemes.

X. Theſe ſeemingly imperfect ſyllogiſms are called *enthymemes*; and occur very frequently in reaſoning, eſpecially where it makes a part of common converſation. Nay, there is a particular elegance in them, becauſe not diſplaying the argument in all its parts, they leave ſomewhat to the exerciſe and invention of the mind. By this means we are put upon exerting ourſelves, and ſeem to ſhare in the diſcovery of what is propoſed to us. Now this is the great ſecret of fine writing, ſo to frame and put together our thoughts, as to give full play to the reader's imagination, and draw him inſenſibly into our very views and courſe of reaſoning. This gives a pleaſure not unlike to that which the author himſelf feels in compoſing. It beſides ſhortens diſcourſe and adds a certain force and livelineſs to our arguments, when the words in which they are conveyed favour the natural quickneſs of the mind in its operations, and a ſingle expreſſion is left to exhibit a whole train of thoughts.

94
Ground of reaſoning in immediate conſequences.

XI. But there is another ſpecies of reaſoning with two propoſitions, which ſeems to be complete in itſelf, and where we admit the concluſion without ſuppoſing any tacit or ſuppreſſed judgment in the mind, from which it follows ſyllogiſtically. This happens between propoſitions, where the connection is ſuch, that the admiſſion of the one neceſſarily and at the firſt ſight implies the admiſſion alſo of the other. For if it ſo falls out, that the propoſition on which the other depends is ſelf-evident, we content ourſelves with barely affirming it, and infer that other by a direct concluſion. Thus, by admitting an univerſal propoſition, we are forced alſo to admit of all the particular propoſitions comprehended under it, this being the very condition that conſtitutes a propoſition univerſal. If then that univerſal propoſition chances to be ſelf-evident, the particular ones follow of courſe, without any farther train of reaſoning. Whoever allows, for inſtance, *that things equal to one and the ſame thing are equal to one another*, muſt at the ſame time allow, *that two triangles, each equal to a ſquare whoſe ſide is three inches, are alſo equal between themſelves*. This argument therefore,

“ Things equal to one and the ſame thing, are
“ equal to one another:
“ Therefore theſe two triangles, each equal to the
“ ſquare of a line of three inches, are equal be-
“ tween themſelves:”

is complete in its kind, and contains all that is neceſſary towards a juſt and legitimate concluſion. For the firſt or univerſal propoſition is ſelf-evident, and therefore requires no farther proof. And as the truth of the particular is inſeparably connected with that of the univerſal, it follows from it by an obvious and unavoidable conſequence.

95
All reducible to ſyllogiſms of ſome one form or other.

XII. Now, in all caſes of this kind, where propoſitions are deduced one from another, on account of a known and evident connection, we are ſaid to reaſon by immediate conſequence. Such a coherence of propoſitions manifeſt at firſt ſight, and forcing itſelf upon the mind, frequently occurs in reaſoning. Logicians have explained at ſome length the ſeveral ſuppoſitions upon which it takes place, and allow of all immediate conſequences that follow in conformity to them. It is however obſervable, that theſe arguments, though ſeemingly complete, becauſe the concluſion follows neceſſarily from the ſingle propoſition that goes before, may yet be conſidered as real enthymemes, whoſe major, which is a conditional propoſition, is wanting. The ſyllogiſm but juſt mentioned, when repreſented according to this view, will run as follows:

“ If things equal to one and the ſame thing, are e-
“ qual to one another; theſe two triangles, each
“ equal to a ſquare whoſe ſide is three inches,
“ are alſo equal between themſelves.
“ But things equal to one and the ſame thing, are
“ equal to one another:
“ Therefore alſo theſe triangles, &c. are equal be-
“ tween themſelves.”

This obſervation will be found to hold in all immediate conſequences whatſoever, inſomuch that they are in fact no more than enthymemes of hypothetical ſyllogiſms. But then it is particular to them, that the ground on which the concluſion reſts, namely, its coherence with the minor, is of itſelf apparent, and ſeen immediately to flow from the rules and reaſons of logic.

96 A ſorites of plain ſimple ſyllogiſms.

XIII. The next ſpecies of reaſoning we ſhall take notice of here is what is commonly known by the name of a *ſorites*. This is a way of arguing, in which a great number of propoſitions are ſo linked together, that the predicate of one becomes continually the ſubject of the next following, until at laſt a concluſion is formed, by bringing together the ſubject of the firſt propoſition, and the predicate of the laſt. Of this kind is the following argument.

“ God is omnipotent :
“ An omnipotent being can do every thing poſſible:
“ He that can do every thing poſſible, can do whatever involves not a contradiction :
“ Therefore God can do whatever involves not a contradiction.”

This particular combination of propoſitions may be continued to any length we pleaſe, without in the leaſt weakening the ground upon which the concluſion reſts. The reaſon is, becauſe the ſorites itſelf may be reſolved into as many ſimple ſyllogiſms as there are middle terms in it; where this is found univerſally to hold, that when ſuch a reſolution is made, and the ſyllogiſms are placed in train, the concluſion of the laſt in the ſeries is alſo the concluſion of the ſorites. This kind of argument, therefore, as it ſerves to unite ſeveral ſyllogiſms into one, muſt ſtand upon the ſame foundation with the ſyllogiſms of which it conſiſts, and is indeed properly ſpeaking, no other than a compendious way of reaſoning ſyllogiſtically.

97 A ſorites of hypothetical ſyllogiſms.

XIV. What is here ſaid of plain ſimple propoſitions may be as well applied to thoſe that are conditional; that is, any number of them may be ſo joined together in a ſeries, that the conſequent of one ſhall become continually the antecedent of the next following; in which caſe, by eſtabliſhing the antecedent of the firſt propoſition, we eſtabliſh the conſequent of the laſt, or by removing the laſt conſequent remove alſo the firſt antecedent. This way of reaſoning is exemplified in the following argument.

“ If we love any perſon, all emotions of hatred towards him ceaſe:
“ If all emotions of hatred towards a perſon ceaſe, we cannot rejoice in his misfortunes :
“ If we rejoice not in his misfortunes, we certainly wiſh him no injury ;
“ Therefore, if we love a perſon, we wiſh him no injury.”

It is evident that this ſorites, as well as the laſt, may be reſolved into a ſeries of diſtinct ſyllogiſms, with this only difference, that here the ſyllogiſms are all conditional.

98 The ground of argumentation in a dilemma.

XV. The laſt ſpecies of ſyllogiſm we ſhall take notice of in this chaper is that commonly diſtinguiſhed by the name of a *dilemma*. A dilemma is an argument by which we endeavour to prove the abſurdity or falſehood of ſome aſſertion. In order to this, we aſſume a conditional propoſition, the antecedent of which is the aſſertion to be diſproved, and the conſequent a disjunctive propoſition, enumerating all the poſſible ſuppoſitions upon which that aſſertion can take place. If then it appears, that all theſe ſeveral ſuppoſitions ought to be rejected, it is plain that the antecedent or aſſertion itſelf muſt be ſo too. When therefore ſuch a propoſition as that beforementioned is made the major of any ſyllogiſm; if the minor rejects all the ſuppoſitions contained in the conſequent, it follows neceſſarily, that the concluſion ought to reject the antecedent, which, as we have ſaid, is the very aſſertion to be diſproved. This particular way of arguing is that which logicians call a *dilemma*; and from the account here given of it, it appears that we may in the general define it to be a hypothetical ſyllogiſm, where the conſequent of the major is a disjunctive propoſition, which is wholly taken away or removed in the minor. Of this kind is the following:

“ If God did not create the world perfect in its kind, it muſt either proceed from want of inclination, or from want of power :
“ But it could not proceed either from want of inclination, or from want of power :
“ Therefore, he created the world perfect in its kind.” Or, which is the ſame thing: “It is abſurd to ſay that he did not create the world perfect in its kind.”

99 An univerſal deſcription of it.

XVI. The nature then of a dilemma is univerſally this. The major is a conditional propoſition, whoſe conſequent contains all the ſeveral ſuppoſitions upon which the antecedent can take place. As therefore theſe ſuppoſitions are wholly removed in the minor, it is evident that the antecedent muſt be ſo too; inſomuch that we here always argue from the removal of the conſequent to the removal of the antecedent. That is, a dilemma is an argument in the *modus tollens* of hypothetical ſyllogiſms, as logicians love to ſpeak. Hence it is plain, that if the antecedent of the major is an affirmative propoſition, the concluſion of the dilemma will be negative; but if it is a negative propoſition, the concluſion will be affirmative.

Chap. V. *Of Induction.*

100 Reaſon at firſt employed about particulars.

I. All reaſoning proceeds ultimately from firſt truths, either ſelf-evident or taken for granted; and the firſt truths of ſyllogiſtic reaſonings are *general* propoſitions. But except in the mathematics, and ſuch other ſciences, as being converſant about mere ideas, have no immediate relation to things without the mind, we cannot aſſume as truths propoſitions which are general. The mathematician indeed may be conſidered as taking his ideas from the beginning in their *general* form. Every *propoſition* compoſed of ſuch ideas is therefore general; and thoſe which are theoretic are reducible to two parts or *terms*, a *predicate*, and a *ſubject*, with a *copula* generally affirmative. If the agreement or the relation between the two terms be not immediate and ſelf evident, he has recourſe to an *axiom*, which is a propoſition ſtill *more general*, and which ſupplies him with a third or *middle term*. This he compares firſt with the *predicate*, and then with the *ſubject*, or *vice verſa*. Theſe two compariſons, when drawn out in form, make two propoſitions.

poſitions, which are called the *premiſes*; and if they happen to be *immediate* and *ſelf-evident*, the *concluſion*, conſiſting of the terms of the queſtion propoſed, is ſaid to be demonſtrated. This method of reaſoning is conducted exactly in the ſyllogiſtic form explained in the preceding chapter.

II. But in ſciences which treat of things external to the mind, we cannot aſſume as *firſt principles* the moſt general propoſitions, and from them infer others leſs and leſs general till we deſcend to particulars. The reaſon is obvious. Every thing in the univerſe, whether of mind or body, preſents itſelf to our obſervation in its individual ſtate; ſo that *perception* and *judgment* employed in the inveſtigation of truth whether *phyſical*, *metaphyſical*, *moral*, or *hiſtorical*, have in the firſt place to encounter with PARTICULARS. "With theſe reaſon begins, or ſhould begin its operations. It obſerves, tries, canvaſſes, examines, and compares them together, and judges of them by ſome of thoſe native evidences and original lights which, as they are the firſt and indiſpenſable inlets of knowledge to the mind, have been called the *primary principles of truth*. See METAPHYSICS.

101 From which, by *induction*, it aſcends to generals or axioms.

III. "By ſuch acts of obſervation and judgment, diligently practiſed and frequently repeated, on many *individuals* of the ſame claſs or of a ſimilar nature, noting their agreements, marking their differences however minute, and rejecting all inſtances which, however ſimilar in appearance, are not in effect the ſame, REASON, with much labour and attention, extracts ſome *general laws* reſpecting the powers, properties, qualities, actions, paſſions, virtues, and relations of *real things*. This is no haſty, premature, *notional* abſtraction of the mind, by which images and ideas are formed that have no archetypes in nature: it is a rational, operative, experimental proceſs, inſtituted and executed upon the conſtitution of beings, which in part compoſe the univerſe. By this proceſs REASON advances from *particulars* to *generals*, from *leſs general* to *more general*, till by a ſeries of ſlow progreſſion, and by regular degrees, it arrive at the *moſt general* notions, called FORMS or FORMAL CAUSES (C). And by *affirming* or *denying* a genus of a ſpecies, or an accident of a ſubſtance or claſs of ſubſtances, through all the ſtages of the gradation, we form *concluſions*, which, if logically drawn, are AXIOMS (D) or general propoſitions ranged one above another, till they terminate in thoſe that are UNIVERSAL.

102 The proceſs of induction exemplified in phyſics.

IV. "Thus, for inſtance, *the evidence of the external ſenſes* is obviouſly the PRIMARY PRINCIPLE from which all phyſical knowledge is derived. But, whereas nature begins with *cauſes*, which, after a variety of changes, produce *effects*, the ſenſes open upon the *effects*, and from them, through the ſlow and painful road of experiment and obſervation, aſcend to *cauſes*. By *experiments* and *obſervations* ſkilfully choſen, artfully conducted, and judiciouſly applied, the philoſopher advances from one ſtage of inquiry to another in the rational inveſtigation of the *general cauſes* of phyſical truth. From different experiments and obſervations made on the ſame individual ſubject, and from the ſame experiments and obſervations made on different ſubjects of the ſame kind, by comparing and judging, he diſcovers ſome *qualities*, *cauſes*, or *phenomena*, which, after carefully diſtinguiſhing and rejecting all contradictory inſtances that occur, he finds common to *many*. Thus, from many collateral compariſons and judgments formed upon *particulars*, he aſcends to *generals*; and by a repetition of the ſame induſtrious proceſs and laborious inveſtigation, he advances from *general* to *more general*, till at laſt he is enabled to form a few of the *moſt general*, with their attributes and operations, into AXIOMS or *ſecondary principles*, which are the well-founded *laws* enacted and enforced by the God of nature.—This is that juſt and philoſophic method of reaſoning which ſound logic preſcribes in this as well as in other parts of learning; by which, through the ſlow but certain road of experiment and obſervation, the mind aſcends from appearances to qualities, from effects to cauſes, and from experiments upon many particular ſubjects forms *general propoſitions* concerning the powers and properties of phyſical body.

103 Axioms, ſo eſtabliſhed, applicable to all parts of learning.

V. "AXIOMS ſo inveſtigated and eſtabliſhed are applicable to all parts of learning, and are the indiſpenſable, and indeed the wonderful expedients, by which in every branch of knowledge, reaſon puſhes on its inquiries in the particular purſuit of truth: and the method of reaſoning by which they are formed, is that of true and legitimate *induction*; which is therefore by Lord

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(C) Qui FORMAS novit, is, quæ adhuc non facta ſunt, qualia nec naturæ viciſſitudines, nec experimentales induſtriæ unquam in actum produxiſſent, nec cogitationem humanam ſubituræ fuiſſent, detegit et educit. *Baconi Nov. Org.*

(D) The word axiom αξιωμα literally ſignifies *dignity*: Hence it is uſed metaphorically to denote a *general truth* or maxim, and ſometimes any truth that is ſelf-evident, which is called *dignity* on account of its importance in a proceſs of reaſoning. The axioms of Euclid are propoſitions extremely general; and ſo are the axioms of the Newtonian philoſophy. But theſe two kinds of axioms have very different origins. The former appear true upon a bare contemplation of our ideas; whereas the latter are the reſult of the moſt laborious induction. Lord Bacon therefore ſtrenuouſly contends that they ſhould never be taken upon conjecture, or even upon the authority of the learned; but that as they are the general principles and grounds of all learning, they ſhould be canvaſſed and examined with the moſt ſcrupulous attention, "ut axiomatum corrigatur iniquitas, quæ plerumque in exemplis vulgatis fundamentum habent:" *De Augm. Sc.* lib. ii. cap. 2. "Atque illa ipſa putativa principia ad rationes reddendas compellare decrevimus quouſque plane conſtant:" *Diſtrib. Operis.*—Dr Tatham makes a diſtinction between axioms *intuitive* and axioms *ſelf-evident*. *Intuitive* axioms, according to him, paſs through the firſt inlets of knowledge, and flaſh direct conviction on the minds, as external objects do on the ſenſes, of all men. Other axioms, though not intuitive, may be properly ſaid to be *ſelf-evident*; becauſe, in their formation, reaſon judges by ſingle compariſons without the help of a third idea or middle term; ſo that they have their evidence in themſelves, and though inductively framed they cannot be ſyllogically proved. If this diſtinction be juſt, and we think it is, only *particular* truths can be intuitive axioms.

Lord Bacon, the beſt and ſoundeſt of logicians, called the *key of interpretation*.

VI. "Inſtead of taking his axioms arbitrarily out of the great families of the categories (ſee CATEGORY), and erecting them by his own ſophiſtical invention into the principles upon which his diſputation was to be employed, had the analytical genius of Ariſtotle preſented us with the laws of the true INDUCTIVE LOGIC, by which AXIOMS are philoſophically formed, and had he with his uſual ſagacity given us an example of it in a ſingle branch of ſcience; he would have brought to the temple of truth an offering more valuable than he has done by the aggregate of all his logical and philoſophical productions.

104 Induction prior to definition,

VII. "In all ſciences, except the mathematics, it is only after the INDUCTIVE proceſs has been induſtriouſly purſued and ſucceſsfully performed, that DEFINITION may be logically and uſefully introduced, by beginning with the *genus*, paſſing through all the graduate and ſubordinate ſtages, and marking the *ſpecific difference* as it deſcends, till it arrive at the *individual*, which is the ſubject of the queſtion. And by adding an *affirmation* or *negation* of the attributive of the *genus* on the *ſpecies* or *individual*, or of a general *accident* on the particular *ſubſtance* ſo defined, making the definition a propoſition, the truth of the queſtion will be logically ſolved without any farther proceſs. So that inſtead of being the *firſt*, as employed by the logic in common uſe, *definition* may be the *laſt* act of reaſon in the ſearch of truth in general.

105 And to ſyllogiſm.

VIII. "Theſe AXIOMS or general propoſitions, thus *inductively* eſtabliſhed, become another ſpecies of PRINCIPLES, which may be properly called SECONDARY, and which lay the foundation of the ſyllogiſtic method of reaſoning. When theſe are formed, but not before, we may ſafely admit the maxim with which logicians ſet out in the exerciſe of their art, as the great hinge on which their reaſoning and diſputation turn: *From truths that are already known, to derive others which are not known.* Or, to ſtate it more comprehenſively, ſo as to apply to probable as well as to ſcientific reaſoning—*From truths which are better known, to derive others which are leſs known.* Philoſophically ſpeaking, ſyllogiſtic reaſoning is, under *general propoſitions* to reduce others which are *leſs general* or which are *particular*; for the *inferior* ones are known to be true, only as we trace their connection with the *ſuperior*. Logically ſpeaking, it is, To predicate a *genus* of a *ſpecies* or *individual* comprehended under it, or an *accident* of the *ſubſtance* in which it is inherent.

106 Induction and ſyllogiſm totally different

IX. "Thus INDUCTION and SYLLOGISM are the two methods of *direct reaſoning* correſponding to the two kinds of principles, *primary* and *ſecondary*, on which they are founded, and by which they are reſpectively conducted. In both methods indeed, reaſon proceeds by *judging* and *comparing*, but the proceſs is different throughout; and though it may have the ſanction of Ariſtotle, an *inductive ſyllogiſm* is a ſoleciſm.

107 Induction the foundation of ſyllogiſm.

X. "Till general truths are aſcertained by induction, the *third* or *middle terms* by which ſyllogiſms are made are no where ſafely to be found. So that another poſition of the Stagyrite, *that ſyllogiſm is naturally prior in order to induction*, is equally unfounded; for *induction* does not only naturally but neceſſarily precede *ſyllogiſm*; and, except in mathematics, is in every reſpect indiſpenſable to its exiſtence; ſince, till generals are eſtabliſhed, there can be neither *definition*, *propoſition*, nor *axiom*, and of courſe no ſyllogiſm. And as induction is the firſt, ſo is it the more *eſſential* and fundamental inſtrument of reaſoning: for as ſyllogiſm cannot produce its own *principles*, it muſt have them from induction; and if the general propoſitions or ſecondary principles be imperfectly or infirmly eſtabliſhed, and much more if they be taken at hazard, upon authority, or by arbitrary aſſumption like thoſe of Ariſtotle, all the ſyllogiſing in the world is a vain and uſeleſs logomachy, only inſtrumental to the multiplication of falſe learning, and to the invention and confirmation of error. The truth of ſyllogiſms depends ultimately on the truth of axioms, and the truth of axioms on the ſoundneſs of inductions (E)."

108 Why we have treated of ſyllogiſm firſt

—But though induction is prior in order, as well as ſuperior in utility, to ſyllogiſm, we have thought it expedient to treat of it laſt; both becauſe ſyllogiſm is an eaſier exerciſe of the reaſoning faculty than induction, and becauſe it is the metod of mathematics, the firſt ſcience of reaſon in which the ſtudent is commonly initiated.

CHAP. VI. *Of Demonſtration.*

I. HAVING diſpatched what ſeemed neceſſary to be ſaid with regard to the two methods of direct reaſoning, *induction* and *ſyllogiſm*; we now proceed to conſider the laws of demonſtration. And here it muſt be acknowledged, that in ſtrict demonſtration, which removes from the mind all poſſibility of doubt or error, the inductive method of reaſoning can have no place. When the experiments and obſervations from which the general concluſion is drawn are numerous and extenſive, the reſult of this mode of reaſoning is moral certainty; and could the induction be made complete, it would be abſolute certainty, equally convincing with mathematical demonſtration. But however numerous and extenſive the obſervations and experiments may be upon which an inductive concluſion is eſtabliſhed, they muſt of neceſſity come ſhort of the number and extent of nature; which, in ſome caſes, by its immenſity, will defeat all poſſibility of their co-extenſion; and in others, by its diſtance, lies out of the reach of their immediate application. Though truth does not appear in all other departments of learning with that bold and reſiſtleſs conviction with which it preſides in the mathematical ſcience, it ſhines through them all, if not interrupted by prejudice or perverted by error, with a clear and uſeful, though inferior ſtrength. And as it is not neceſſary for the general ſafety or convenience of a traveller, that he ſhould always enjoy the heat and ſplendor of a mid-day ſun, whilſt he can with more eaſe purſue his journey under the weaker influence of a morning or an evening ray; ſo it is not requiſite, for the various concerns and purpoſes

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(E). This chapter is almoſt wholly taken from *Tatham's Chart and Scale of Truth*; a work, which, notwithſtanding the ruggedneſs of its ſtyle, has ſo much real merit as a ſyſtem of logic, that it cannot be too diligently ſtudied by the young inquirer who wiſhes to travel by the ſtraight road to the temple of Science.

poſes of life, that men ſhould be led by truth of the moſt redundant brightneſs. Such truth is to be had only in thoſe ſciences which are converſant about ideas and their various relations; where every thing being certainly what it appears to be, definitions and axioms ariſe from mere intuition. Here *ſyllogyſm* takes up the proceſs from the beginning; and by a ſublime intellectual motion advances from the ſimpleſt axioms to the moſt complicated ſpeculations, and exhibits truth ſpringing out of its firſt and pureſt elements, and ſpreading on all ſides into a ſyſtem of ſcience. As each ſtep in the progreſs is ſyllogiſtic, we ſhall endeavour to explain the uſe and application of ſyllogiſms in this ſpecies of reaſoning.

109
Of reaſoning by a concatenation of ſyllogiſms.

We have ſeen, that in all the different appearances they put on, we ſtill arrive at a juſt and legitimate concluſion; now it often happens, that the concluſion of one ſyllogiſm becomes a previous propoſion in another; by which means great numbers of them are ſometimes linked together in a ſeries, and truths are made to follow one another in train. And as in ſuch a concatenation of ſyllogiſms all the various ways of reaſoning that are truly concluſive may be with ſafety introduced; hence it is plain, that in deducing any truth from its firſt principles, eſpecially where it lies at a conſiderable diſtance from them, we are at liberty to combine all the ſeveral kinds of ſoilogiſms above explained, according as they are found beſt to ſuit the end and purpoſe of our enquiries. When a propoſition is thus by means of ſyllogiſms, collected from others more evident and known, it is ſaid to be *proved*; ſo that we may in the general define the proof of a propoſition to be a ſyllogiſm, or ſeries of ſyllogiſms, collecting that propoſition from known and evident truths. But more particularly, if the ſyllogiſms of which the proofs conſiſt admit of no premiſes but definitions, ſelf-evident truths, and propoſitions already eſtabliſhed, then is the argument ſo conſtituted called a *demonſtration*; whereby it appears that demonſtrations are ultimately founded on definitions and ſelf-evident propoſitions.

110
All ſyllogiſms whatſoever reducible to the firſt figure.

II. All ſyllogiſms whatſoever, whether compound, multiform, or defective, are reducible to plain ſimple ſyllogiſms in ſome one of the four figures. But this is not all. Syllogiſms of the firſt figure, in particular, admit of all poſſible concluſions: that is, any propoſitions whatſoever, whether an univerſal affirmative or univerſal negative, a particular affirmative or particular negative, which fourfold diviſion embraces all their varieties; any one of theſe may be inferred by virtue of ſome ſyllogiſm in the firſt figure. By this means it happens that the ſyllogiſms of all the other figures are reducible alſo to ſyllogiſms of the firſt figure, and may be conſidered as ſtanding on the ſame foundation with them. We cannot here demonſtrate and explain the manner of this reduction, becauſe it would too much ſwell the bulk of this treatiſe. It is enough to take notice that the thing is univerſally known and allowed among logicians, to whoſe writings we refer ſuch as deſire farther ſatiſfaction in this matter. This then being laid down, it is plain that any demonſtration whatſoever may be conſidered as compoſed of a ſeries of ſyllogiſms, all in the firſt figure. For, ſince all the ſyllogiſms that enter the demonſtration are reducible to ſyllogiſms of ſome one of the four figures; and ſince the ſyllogiſms of all the other figures are farther reducible to ſyllogiſms of the firſt figure, it is evident, that the whole demonſtration may be reſolved into a ſeries of theſe laſt ſyllogiſms. Let us now, if poſſible diſcover the ground upon which the concluſion reſts in ſyllogiſms of the firſt figure; becauſe, by ſo doing, we ſhall come at an univerſal principle of certainty, whence the evidence of all demonſtrations in all their parts may be ultimately derived.

111
The ground of reaſoning in the firſt figure.

III. The rules then of the firſt figure are briefly theſe. The middle term is the ſubject of the major propoſition, and the predicate of the minor. The major is always an univerſal propoſition, and the minor always affirmative. Let us now ſee what effect theſe rules will have in reaſoning. The major is an univerſal propoſition, of which the middle term is the ſubject, and the predicate of the concluſion the predicate. Hence it appears, that in the major the predicate of the concluſion is always affirmed or denied univerſally of the middle term. Again, the minor is an affirmative propoſition, whereof the ſubject of the concluſion is the ſubject, and the middle term the predicate. Here then the middle term is affirmed of the ſubject of the concluſion; that is, the ſubject of the concluſion is affirmed to be comprehended under, or to make a part of, the middle term, Thus then we ſee what is done in the premiſes of a ſyllogiſm of the firſt figure. The predicate of the concluſion is univerſally affirmed or denied of ſome idea. The ſubject of the concluſion is affirmed to be or to make a part of that idea. Hence it naturally and unavoidably follows, that the predicate of the concluſion ought to be affirmed or denied of the ſubject. To illuſtrate this by an example, we ſhall reſume one of the ſyllogiſms of the firſt chapter.

“Every creature poſſeſſed of reaſon and liberty is
“accountable for his actions:
“Man is a creature poſſeſſed of reaſon and liberty:
“Therefore man is accountable for his actions.”

Here, in the firſt propoſition, the predicate of the concluſion, *accountableneſs*, is affirmed of all creatures that have reaſon and liberty. Again, in the ſecond propoſition, *man*, the ſubject of the concluſion, is affirmed to be or to make a part of this claſs of creatures. Hence the concluſion neceſſarily and unavoidably follows, *viz.* that man is accountable for his actions; becauſe, if reaſon and liberty be that which conſtitutes a creature accountable, and man has reaſon and liberty, it is plain he has that which conſtitutes him accountable. In like manner, where the major is a negative propoſition, or denies the predicate of the concluſion univerſally of the middle term, as the minor always aſſerts the ſubject of the concluſion to be or make a part of that middle term, it is no leſs evident that the predicate of the concluſion ought in this caſe to be denied of the ſubject. So that the ground of reaſoning, in all ſyllogiſms of the firſt figure, is manifeſtly this: “Whatever may be affirmed univerſally of any idea, may be affirmed of every or any number of particulars comprehended under that idea.” And again: “Whatever may be denied univerſally of any idea, may be in like manner denied of every or any number of its individuals. Theſe two propoſitions are called by logicians the *dictum de omni*, and *dictum de nullo*; and are indeed the great principles of ſyllogiſtic reaſoning, inſomuch as all concluſions whatſoever either reſt immediately upon them, or upon propoſitions deduced from them. But what adds greatly to their value is, that they are really ſelf-evident truths, and ſuch as we cannot gainſay without running into an expreſs contradiction. To affirm, for inſtance, that *no man is perfect*, and yet argue that *ſome men are perfect*; or to ſay that *all men are mortal*, and yet that *ſome men are not mortal*, is to aſſert a thing to be and not to be at the ſame time.

112 **Demonſtration an infallible guide to truth and certainty.**

IV. And now we may affirm, that, in all ſyllogiſms of the firſt figure, if the premiſes are true, the concluſion muſt needs be true. If it be true that the predicate of the concluſion, whether affirmative or negative, agrees univerſally to ſome idea; and if it be alſo true that the ſubject of the concluſion is a part of or comprehended under that idea; then it neceſſarily follows, that the predicate of the concluſion agrees alſo to the ſubject. For to aſſert the contrary, would be to run counter to ſome one of the two principles before eſtabliſhed; that is, it would be to maintain an evident contradiction. And thus we are come at laſt to the point we have been all along endeavouring to eſtabliſh; namely, that every propoſition which can be demonſtrated is neceſſarily true. For as every demonſtration may be reſolved into a ſeries of ſyllogiſms all in the firſt figure; and as in any one of theſe ſyllogiſms, if the premiſes are true, the concluſion muſt needs be ſo too; it evidently follows, that if all the ſeveral premiſes are true, all theſe ſeveral concluſions are ſo, and conſequently the concluſion alſo of the laſt ſyllogiſm, which is always the propoſition to be demonſtrated. Now that all the premiſes of a demonſtration are true, will eaſily appear from the very nature and definition of that form of reaſoning. A demonſtration as we have ſaid, is a ſeries of ſyllogiſms, all whoſe premiſes are either definitions, ſelf-evident truths, or propoſitions already eſtabliſhed. Definitions are identical propoſitions, wherein we connect the deſcription of an idea with the name by which we chooſe to have that idea called, and therefore as to their truth there can be no diſpute. Self-evident propoſitions appear true of themſelves, and leave no doubt or uncertainty in the mind. Propoſitions, before eſtabliſhed, are no other than concluſions gained by one or more ſteps from definitions and ſelf-evident principles, that is, from true premiſes, and therefore muſt needs be true. Whence all the previous propoſitions of a demonſtration being, we ſee, manifeſtly true; the laſt concluſion, or propoſition to be demonſtrated, muſt be ſo too. So that demonſtration not only leads to certain truth, but we have here alſo a clear view of the ground and foundation of that certainty. For as, in demonſtrating, we may be ſaid to do nothing more than combine a ſeries of ſyllogiſms together, all reſting on the ſame bottom; it is plain that one uniform ground of certainty runs through the whole, and that the concluſions are every where built upon ſome one of the two principles before eſtabliſhed, as the foundation of all our reaſoning. Theſe two principles are eaſily reduced into one, and may be expreſſed thus: "Whatever predicate, whether affirmative or negative, agrees univerſally to any idea; the ſame muſt needs agree to every or any number of individuals comprehended under that idea." And thus at length we have, according to our firſt deſign, reduced the certainty of demonſtration to one ſimple and univerſal principle; which carries its own evidence along with it, and which is indeed the ultimate foundation of all ſyllogiſtic reaſoning.

113 **The rules of logic furniſh a ſufficient criterion for the diſtinguiſhing between truth and falſehood.**

V. Demonſtration therefore ſerving as an infallible guide to truth, and ſtanding on ſo ſure and unalterable a baſis, we may now venture to aſſert, that the rules of logic furniſh a ſufficient criterion for the diſtinguiſhing between truth and falſehood. For ſince every propoſition that can be demonſtrated is neceſſarily true, he is able to diſtinguiſh truth from falſehood who can with certainty judge when a propoſition is truly demonſtrated. Now, a demonſtration is, as we have ſaid, nothing more than a concatenation of ſyllogiſms, all whoſe premiſes are definitions, ſelf-evident truths, or propoſitions previouſly eſtabliſhed. To judge therefore of the validity of a demonſtration, we muſt be able to diſtinguiſh whether the definitions that enter it are genuine, and truly deſcriptive of the ideas they are meant to exhibit: whether the propoſitions aſſumed without proofs as intuitive truths have really that ſelf evidence to which they lay claim: whether the ſyllogiſms are drawn up in due form, and agreeable to the laws of argumentation: in fine, whether they are combined together in a juſt and orderly manner, ſo that no demonſtrable propoſitions ſerve any where as premiſes unleſs they are concluſions of previous ſyllogiſms. Now, it is the buſineſs of logic, in explaining the ſeveral operations of the mind, fully to inſtruct us in all theſe points. It teaches the nature and end of definitions, and lays down the rules by which they ought to be framed. It unfolds the ſeveral ſpecies of propoſitions, and diſtinguiſhes the ſelf-evident from the demonſtrable. It delineates alſo the different forms of ſyllogiſms, and explains the laws of argumentation proper to each. In fine, it deſcribes the manner of combining ſyllogiſms, ſo as that they may form a train of reaſoning, and lead to the ſucceſſive diſcovery of truth. The precepts of logic, therefore, as they enable us to judge with certainty when a propoſition is duly demonſtrated, furniſh a ſure criterion for the diſtinguiſhing between truth and falſehood.

114 **And extending to all caſes where a certain knowledge of truth is attainable.**

VII. Perhaps it may be objected, that demonſtration is a thing very rare and uncommon, as being the prerogative of but a few ſciences, and therefore the criterion here given can be of no great uſe. But wherever, by the bare contemplation of our ideas, truth is diſcoverable, there alſo demonſtration may be attained. Now that is an abundantly ſufficient criterion which enables us to judge with certainty in all caſes where the knowledge of truth comes within our reach; for with diſcoveries, that lie beyond the limits of the human mind, we have, properly, no buſineſs or concernment. When a propoſition is demonſtrated, we are certain of its truth. When, on the contrary, our ideas are ſuch as have no viſible connection or repugnance, and therefore furniſh not the proper means of tracing their agreement or diſagreement, there we are ſure that ſcientifical knowledge is not attainable. But where there is ſome foundation of reaſoning, which yet amounts not to the full evidence of demonſtration, there the precepts of logic, by teaching us to determine aright of the degree of proof, and of what is ſtill wanting to render it full and complete, enable us to make a due eſtimate of the meaſures of probability, and to proportion our aſſent to the grounds on which the propoſition ſtands. And this is all we can poſſibly arrive at, or even ſo much as hope for, in the exerciſe of faculties ſo imperfect and limited as ours.

115 The diſtinction of demonſtration into direct and indirect.

VII. Before we conclude this chapter, it may not be improper to take notice of the diſtinction of demonſtration into *direct* and *indirect*. A *direct demonſtration* is, when, beginning with definitions, ſelf-evident propoſitions, or known and allowed truths, we form a train of ſyllogiſms, and combine them in an orderly manner, continuing the ſeries through a variety of ſucceſſive ſteps, until at laſt we arrive at a ſyllogiſm whoſe concluſion is the propoſition to be demonſtrated. Proofs of this kind leave no doubt or uncertainty behind them; becauſe, all the ſeveral premiſes being true, the concluſions muſt be ſo too, and of courſe the very laſt concluſion or propoſition to be proved. The other ſpecies of demonſtration is the *indirect*, or, as it is ſometimes called, the *apogogical*. The manner of proceeding here is, by aſſuming a propoſition which directly contradicts that we mean to demonſtrate; and thence, by a continued train of reaſoning, in the way of a direct demonſtration, deducing ſome abſurdity or manifeſt untruth. For hereupon we conclude, that the propoſition aſſumed was falſe; and thence again, by an immediate conſequence, that the propoſition to be demonſtrated is true. Thus Euclid, in his third book, being to demonſtrate *that circles which touch one another inwardly have not the ſame centre*, aſſumes the direct contrary to this, viz. *that they have the ſame centre*; and thence, by an evident train of reaſoning, proves *that a part is equal to the whole*. The ſuppoſition therefore leading to this abſurdity he concludes to be falſe, viz. *that circles touching one another inwardly have the ſame centre*; and thence again immediately infers, *that they have not the ſame centre*.

116 Ground of reaſoning in indirect demonſtrations.

VIII. Now, becauſe this manner of demonſtration is accounted by ſome not altogether ſo clear and ſatisfactory; we ſhall therefore endeavour to ſhow; that it equally with the other leads to truth and certainty. Two propoſitions are ſaid to be *contradictory* one of another, when that which is aſſerted to be in the one is aſſerted not to be in the other. Thus the propoſitions, *Circles that touch one another inwardly have the ſame centre*, and *Circles that touch one another inwardly have not the ſame centre*, are *contradictories*, becauſe the ſecond aſſerts the direct contrary of what is aſſerted in the firſt. Now, in all contradictory propoſitions, this holds univerſally, That one of them is neceſſarily true, and the other neceſſarily falſe. For if it be true, that circles which touch one another inwardly have not the ſame centre; it is unavoidably falſe, that they have the ſame centre. On the other hand, if it be falſe that they have the ſame centre, it is neceſſarily true that they have not the ſame centre. Since therefore it is impoſſible for them to be both true or both falſe at the ſame time; it unavoidably follows, that one is neceſſarily true, and the other neceſſarily falſe. This then being allowed, which is ſelf-evident; if any two contradictory propoſitions are aſſumed, and one of them can by a clear train of reaſoning be demonſtrated to be falſe, it neceſſarily follows that the other is true. For as the one is neceſſarily true, and the other neceſſarily falſe; when we come to diſcover which is the falſe propoſition, we thereby alſo know the other to be true.

117 Indirect demonſtrations a ſure guide to certainty.

IX. Now this is preciſely the manner of an indirect demonſtration, as is evident from the account given of it above. For there we aſſume a propoſition which directly contradicts that we mean to demonſtrate; and, having by a continued ſeries of proofs ſhown it to be falſe, thence infer that its contradictory, or the propoſition to be demonſtrated is true. As, therefore, this laſt concluſion is certain and unavoidable; let us next inquire after what manner we come to be ſatisfied of the falſehood of the aſſumed propoſition, that ſo no poſſible doubt may remain as to the force and validity of demonſtrations of this kind. The manner then is plainly this: Beginning with the aſſumed propoſition, we, by the help of definitions, ſelf-evident truths, or propoſitions already eſtabliſhed, continue a ſeries of reaſoning, in the direct way of a demonſtration, until at length we arrive at ſome abſurdity or known falſehood. Thus Euclid, in the example beforementioned, from the ſuppoſition that circles touching one another inwardly have the ſame centre, deduces *that a part is equal to the whole*. Since, therefore, by a due and orderly proceſs of reaſoning, we come at laſt to a falſe concluſion; it is manifeſt, that all the premiſes cannot be true; for, were all the premiſes true, the laſt concluſion muſt be ſo too, by what has been before demonſtrated. Now, as to all the other premiſes made uſe of in the courſe of reaſoning, they are manifeſt and known truths by ſuppoſition, as being either definitions, ſelf-evident propoſitions, or truths previouſly eſtabliſhed. The aſſumed propoſition is that only as to which any doubt or uncertainty remains. That alone, therefore, can be falſe; and indeed, from what has been already ſhown, muſt unavoidably be ſo. And thus we ſee, that in indirect demonſtrations, two contradictory propoſitions being laid down, one of which is demonſtrated to be falſe, the other, which is always the propoſition to be proved muſt neceſſarily be true; ſo that here as well as in the direct way of proof, we arrive at a clear and ſatisfactory knowledge of truth.

118 A particular caſe of indirect demonſtration.

X. This is univerſally the method of reaſoning in all apogogical or indirect demonſtrations. But if any propoſition is aſſumed, from which, in a direct train of reaſoning, we can deduce its contradictory; the propoſition ſo aſſumed is falſe, and the contradictory one true. For if we ſuppoſe the aſſumed propoſition to be true, then, ſince all the other premiſes that enter the demonſtration are alſo true, we ſhall have a ſeries of reaſoning conſiſting wholly of true premiſes; whence the laſt concluſion or contradictory of the aſſumed propoſition muſt be true likewiſe: ſo that by this means we ſhould have two contradictory propoſitions both true at the ſame time, which is manifeſtly impoſſible. The aſſumed propoſition, therefore, whence this abſurdity flows, muſt neceſſarily be falſe; and conſequently its contradictory, which is here the propoſition deduced from it, muſt be true. If then any propoſition is propoſed to be demonſtrated, and we *aſſume* the *contradictory* of that propoſition, and thence directly infer the propoſition to be demonſtrated; by this very means we know that the propoſition ſo inferred is true. For, ſince from an aſſumed propoſition we have deduced its contradictory, we are thereby certain that the aſſumed propoſition is falſe; and if ſo, then its contradictory, or that deduced from it, which in this caſe is the ſame with the propoſition to be demonſtrated, muſt be true.

119 A due knowledge of the principles of logic indiſpenſably neceſſary to make us proper judges of demonſtration.

XI. We have a curious inſtance of this in the twelfth propoſition of the ninth book of the Elements. Euclid there propoſes to demonſtrate, *that in any ſeries of numbers, riſing from unity in geometrical progreſſion, all the prime numbers that meaſure the laſt term in the ſeries will alſo meaſure the next after unity.* In order to this, he aſſumes the contradictory of the propoſition to be demonſtrated; namely, *that ſome prime number meaſuring the laſt term in the ſeries does not meaſure the next after unity;* and thence, by a continued train of reaſoning, proves that it actually does meaſure it. Hereupon he concludes the aſſumed propoſition to be falſe; and that which is deduced from it, or its contradictory, which is the very propoſition he propoſed to demonſtrate, to be true. Now that this is a juſt and concluſive way of reaſoning, is abundantly manifeſt from what we have ſo clearly eſtabliſhed above. Whence it appears, how neceſſary ſome knowledge of the rules of logic is, to enable us to judge of the force, juſtneſs, and validity, of demonſtrations. For, though it is readily allowed, that by the mere ſtrength of our natural faculties we can at once diſcern, that of two contradictory propoſitions, the one is neceſſarily true, and the other neceſſarily falſe; yet when they are ſo linked together in a demonſtration, as that the one ſerves as a previous propoſition whence the other is deduced, it does not ſo immediately appear, without ſome knowledge, of the principles of logic, why that alone, which is collected by reaſoning, ought to be embraced as true, and the other, whence it is collected, to be rejected as falſe.

120 And of itſelf ſufficient to guard us againſt error and falſe reaſoning.

XII. Having thus ſufficiently evinced the certainty of demonſtration in all its branches, and ſhown the rules by which we ought to proceed, in order to arrive at a juſt concluſion, according to the various ways of arguing made uſe of; it is needleſs to enter upon a particular conſideration of thoſe ſeveral ſpecies of falſe reaſoning which logicians diſtinguiſh by the name of *ſophiſms.* He that thoroughly underſtands the form and ſtructure of a good argument, will of himſelf readily diſcern every deviation from it. And although *ſophiſms* have been divided into many claſſes, which are all called by ſounding names, that therefore carry in them much appearance of learning; yet are the errors themſelves ſo very palpable and obvious, that it would be loſt labour to write for a man capable of being miſled by them. Here, therefore, we chooſe to conclude this part of logic; and ſhall in the next give ſome account of *Method:* which, though inſeparable from reaſoning, is nevertheleſs always conſidered by logicians as a diſtinct operation of the mind; becauſe its influence is not confined to the mere exerciſe of the reaſoning faculty, but extends in ſome degree to all the tranſactions of the underſtanding.

Part IV. Of METHOD.

121 The underſtanding ſometimes employed in putting together known truths.

WE have now done with the three firſt operations of the mind, whoſe office it is to ſearch after truth, and enlarge the bounds of human knowledge. There is yet a fourth, which regards the diſpoſal and arrangement of our thoughts, when we endeavour ſo to put them together as that their mutual connection and dependence may be clearly ſeen. This is what logicians call *Method,* and place always the laſt in order in explaining the powers of the underſtanding; becauſe it neceſſarily ſuppoſes a previous exerciſe of our other faculties, and ſome progreſs made in knowledge before we can exert it in any extenſive degree.

122 Sometimes in the ſearch and diſcovery of ſuch as are unknown.

II. In this view, it is plain that we muſt be beforehand well acquainted with the truths we are to combine together; otherwiſe, how could we diſcern their ſeveral connections and relations, or ſo diſpoſe of them as their mutual dependence may require? But it often happens, that the underſtanding is employed, not in the arrangement and compoſition of known truths, but in the ſearch and diſcovery of ſuch as are unknown. And here the manner of proceeding is very different. We aſſemble at once our whole ſtock of knowledge relating to any ſubject, and, after a general ſurvey of things, begin with examining them ſeparately and by parts. Hence it comes to paſs, that whereas, at our firſt ſetting out, we were acquainted only with ſome of the grand ſtrokes and outlines of truth; by thus purſuing her through her ſeveral windings and receſſes, we gradually diſcover thoſe more inward and finer touches whence ſhe derives all her ſtrength, ſymmetry, and beauty. And here it is, that when, by a narrow ſcrutiny into things, we have unravelled any part of knowledge, and traced it to its firſt and original principles, inſomuch that the whole frame and contexture of it lies open to the view of the mind; here it is, that, taking it the contrary way, and beginning with theſe principles, we can ſo adjuſt and put together the parts as the order and method of ſcience requires.

123 Illuſtrated by the ſimilitude of a watch.

III. But as theſe things are beſt underſtood when illuſtrated by examples; let us ſuppoſe any machine, for inſtance a watch, preſented to us, whoſe ſtructure and compoſition we are as yet unacquainted with, but want, if poſſible, to diſcover. The manner of proceeding, in this caſe, is, by taking the whole to pieces, and examining the parts ſeparately, one after another. When, by ſuch a ſcrutiny, we have thoroughly informed ourſelves of the frame and contexture of each, we then compare them together, in order to judge of their mutual action and influence. By this means we gradually trace out the inward make and compoſition of the whole, and come at length to diſcern how parts of ſuch a form, and ſo put together as we found in unravelling and taking them aſunder, conſtitute that particular machine called a *watch,* and contribute to all the ſeveral motions and phenomena obſervable in it. This diſcovery being made, we can take things the contrary way, and, beginning with the parts, ſo diſpoſe and connect them as their ſeveral uſes and ſtructures require, until at length we arrive at the whole itſelf, from the unravelling of which thoſe parts reſulted.

124 Ground of the analytic and ſynthetic methods.

IV. And as it is in tracing and examining the works of art; ſo is it, in a great meaſure, in unfolding any part of human knowledge: for the relations and mutual habitudes of things do not always immediately appear upon comparing them one with another. Hence we have recourſe to intermediate ideas; and, by means of them, are furniſhed with thoſe previous propoſitions that lead to the concluſion we are in queſt of. And if it ſo happen that the previous propoſitions themſelves are not ſufficiently evident, we endeavour, by new middle terms, to aſcertain their truth; ſtill tracing things backward, in a continual ſeries, until at length we arrive at ſome ſyllogiſm where the premiſes are firſt and ſelf-evident principles. This done, we become perfectly ſatisfied as to the truth of all the concluſions we have paſſed through, inaſmuch as they are now ſeen to ſtand upon the firm and immoveable foundation of our intuitive perceptions. And as we arrived at this certainty by tracing things backward to the original principles whence they flow; ſo we may at any time renew it by a direct contrary proceſs, if, beginning with theſe principles, we carry the train of our thoughts forward until they lead us, by a connected chain of proofs, to the very laſt concluſion of the ſeries.

125 Diviſion of method into analytic and ſynthetic.

V. Hence it appears, that, in diſpoſing and putting together our thoughts, either for our own uſe, that the diſcoveries we have made may at all times lie open to the review of the mind, or where we mean to communicate and unfold the diſcoveries to others, there are two ways of proceeding equally within our choice: for we may ſo propoſe the truths relating to any part of knowledge, as they preſented themſelves to the mind in the manner of inveſtigation; carrying on the ſeries of proofs, in a reverſe order, until they at laſt terminate in firſt principles: or, beginning with theſe principles, we may take the contrary way, and from them deduce, by a direct train of reaſoning, all the ſeveral propoſitions we want to eſtabliſh. This diverſity in the manner of arranging our thoughts gives riſe to the twofold diviſion of method eſtabliſhed among logicians: for method, according to their uſe of the word, is nothing elſe but the order and diſpoſition of our thoughts relating to any ſubject. When truths are ſo propoſed and put together as they were or might have been diſcovered, this is called the *analytic method*, or the *method of reſolution*; inaſmuch as it traces things backward to their ſource, and reſolves knowledge into its firſt and original principles. When, on the other hand, they are deduced from theſe principles, and connected according to their mutual dependence, inſomuch that the truths firſt in order tend always to the demonſtration of thoſe that follow; this conſtitutes what we call the *ſynthetic method*, or *method of compoſition*. For here we proceed by gathering together the ſeveral ſcattered parts of knowledge, and combining them into one whole ſyſtem, in ſuch manner that the underſtanding is enabled diſtinctly to follow truth through all her different ſtages and gradations.

126 Called otherwiſe the method of invention, and the method of ſcience.

VI. There is this farther to be taken notice of, in relation to theſe two ſpecies of method; that the firſt has alſo obtained the name of the *method of invention*, becauſe it obſerves the order in which our thoughts ſucceed one another in the invention or diſcovery of truth. The other, again, is often denominated the *method of doctrine* or *inſtruction*; inaſmuch as, in laying our thoughts before others, we generally chooſe to proceed in the ſynthetic manner, deducing them from their firſt principles. For we are to obſerve, that although there is great pleaſure in purſuing truth in the method of inveſtigation, becauſe it places us in the condition of the inventor, and ſhows the particular train and proceſs of thinking by which he arrived at his diſcoveries; yet it is not ſo well accommodated to the purpoſes of evidence and conviction. For, at our firſt ſetting out, we are commonly unable to divine where the analyſis will lead us; inſomuch that our reſearches are for ſome time little better than a mere groping in the dark. And even after light begins to break in upon us, we are ſtill obliged to many reviews, and a frequent compariſon of the ſeveral ſteps of the inveſtigation among themſelves. Nay when we have unravelled the whole, and reached the very foundation on which our diſcoveries ſtand, all our certainty, in regard to their truth, will be found in a great meaſure to ariſe from that connection we are now able to diſcern between them and firſt principles, taken in the order of compoſition. But in the ſynthetic manner of diſpoſing our thoughts, the caſe is quite different: for as we here begin with the intuitive truths, and advance by regular deductions from them, every ſtep of the procedure brings evidence and conviction along with it; ſo that, in our progreſs from one part of knowledge to another, we have always a clear perception of the ground on which our aſſent reſts. In communicating therefore our diſcoveries to others, this method is apparently to be choſen, as it wonderfully improves and enlightens the underſtanding, and leads to an immediate perception of truth.

VII. The logic which for ſo many ages kept poſſeſſion of the ſchools, and was deemed the moſt important of the ſciences, has long been condemned as a mere art of wrangling, of very little uſe in the purſuit of truth. Attempts have been made to reſtore it to credit, but without ſucceſs; and of late years little or no attention whatever has been paid to *the art of reaſoning* in the courſe of what is called a liberal education. As both extremes may be faulty, it ſhould ſeem that we cannot conclude this ſhort treatiſe more properly than with the following

REFLECTIONS on the Utility of LOGIC.

IF Ariſtotle was not the inventor of logic, he was certainly the prince of logicians. The whole theory of ſyllogiſms he claims as his own, and as the fruit of much time and labour; and it is univerſally known, that the later writers on the art have borrowed their materials almoſt entirely from his Organon and Porphyry's Introduction. But after men had laboured near 2000 years in ſearch of truth by the help of ſyllogiſms, Lord Bacon propoſed the method of induction, as a more effectual engine for that purpoſe; and ſince his days the art of logic has gradually fallen into diſrepute.

To this conſequence many cauſes contributed. The art of ſyllogiſm is admirably calculated for wrangling; and by the ſchoolmen it was employed with too much ſucceſs, to keep in countenance the abſurdities of the Romiſh church. Under their management it produced numberleſs diſputes, and numberleſs ſects, who fought againſt each other with much animoſity without gaining or loſing ground; but it did nothing conſiderable for the benefit of human life, whilſt the method of induction has improved arts and increaſed knowledge. It is no wonder, therefore, that the exceſſive admiration of Ariſtotle, which continued for ſo many ages, ſhould end in an undue contempt; and that the high eſteem of logic, as the grand engine of ſcience, ſhould at laſt make way for too unfavourable an opinion, which ſeems now prevalent, of its being unworthy of a place in a liberal education. Men rarely leave one extreme without running into the contrary: Thoſe who think according to the faſhion, will be as prone to go into the preſent extreme as their grandfathers were to go into the former; and even they who in *general* think for themſelves, when they are offended at the abuſe of any thing, are too apt to entertain prejudices againſt the *thing itſelf*. "In practice (ſays the learned WARBURTON [†]), logic is more a *trick* than a *ſcience*, formed rather to amuſe than to inſtruct. And in ſome ſort we may apply to the art of ſyllogiſm what a man of wit ſays of rhetoric, that it only tells us how to *name* thoſe tools which nature had before put into our hands. In the ſervice of chicane, indeed, it is a mere juggler's knot, now faſt, now looſe; and the ſchools where this legerdemain was exerciſed in great perfection are full of the ſtories of its wonders." The authority of *Warburton* is great; but it may be counterbalanced by another which, on ſubjects of this nature, is confeſſedly greater.

"Laying aſide prejudice, whether faſhionable or unfaſhionable, let us conſider (ſays Dr REID [‡]) whether logic is or may be made ſubſervient to any good purpoſe. Its profeſſed end is, to teach men to think, to judge, and to reaſon, with preciſion and accuracy. No man will ſay that this is a matter of little importance: the only thing therefore that can admit of doubt is, whether it can be taught?

"To reſolve this doubt, it may be obſerved, that our rational faculty is the gift of God, given to men in very different meaſures: Some have a large portion, ſome a leſs; and where there is a remarkable defect of the natural power, it cannot be ſupplied by any culture. But this natural power, even where it is the ſtrongeſt, may lie dead for want of the means of improvement. Many a ſavage may have been born with as good faculties as a *Newton*, a *Bacon*, or an *Ariſtotle*; but their talents were buried by having never been put to uſe, whilſt thoſe of the philoſophers were cultivated to the beſt advantage. It may likewiſe be obſerved, that the chief mean of improving our rational power, is the vigorous exerciſe of it in various ways and on different ſubjects, by which the habit is acquired of exerciſing it properly. Without ſuch exerciſe, and good ſenſe over and above, a man who has ſtudied logic all his life may be only a petulant wrangler, without true judgment or ſkill of reaſoning in any ſcience."

This muſt have been Locke's meaning, when in his Thoughts on Education he ſays, "If you would have your ſon to reaſon well, let him read Chillingworth." The ſtate of things is much altered ſince Locke wrote: Logic has been much improved chiefly by his writings; and yet much leſs ſtreſs is laid upon it, and leſs time conſumed in its ſtudy. His counſel, therefore, was judicious and ſeaſonable; to wit, That the improvement of our reaſoning power is to be expected much more from an intimate acquaintance with the authors who reaſon beſt, than from ſtudying voluminous ſyſtems of ſchool logic. But if he had meant that the ſtudy of logic was of no uſe, nor deſerved any attention, he ſurely would not have taken the pains to make ſo conſiderable an addition to it, by his *Eſſay on the Human Underſtanding*, and by his *Thoughts on the Conduct of the Underſtanding*; nor would he have remitted his pupil to *Chillingworth*, the acuteſt logician as well as the beſt reaſoner of his age."

There is no ſtudy better fitted to exerciſe and ſtrengthen the reaſoning powers than that of the mathematical ſciences; becauſe there is no other branch of ſcience which gives ſuch ſcope to long and accurate trains of reaſoning, or in which there is ſo little room for authority or prejudice of any kind to give a falſe bias to the judgment. When a youth of moderate parts begins to ſtudy Euclid, every thing is new to him: His apprehenſion is unſteady; his judgment is feeble; and reſts partly upon the evidence of the thing, and partly upon the authority of his teacher. But every time he goes over the definitions, the axioms, the elementary propoſitions, more light breaks in upon him; and as he advances, the road of demonſtration becomes ſmooth and eaſy: he can walk in it firmly, and take wider ſteps, till at laſt he acquires the habit not only of underſtanding a demonſtration, but of diſcovering and demonſtrating mathematical truths.

It muſt indeed be confeſſed, that a man without the rules of logic may acquire a habit of reaſoning juſtly in *mathematics*, and perhaps in any other ſcience. Good ſenſe, good examples, and aſſiduous exerciſe, may bring a man to reaſon juſtly and acutely in his own profeſſion without rules. But whoever thinks, that from this conceſſion he may infer the inutility of logic, betrays by this inference a great want of that art; for he might as well infer, becauſe a man *may* go from Edinburgh to London by the way of Paris, that therefore *any other* road is uſeleſs.

There is perhaps no art which may not be acquired, in a very conſiderable degree, by example and practice, without reducing it to rules. But practice joined with rules may carry a man forward in his art farther and more quickly than practice without rules.— Every ingenious artiſt knows the utility of having his art reduced to rules, and thereby made a ſcience. By rules he is enlightened in his practice, and works with more aſſurance. They enable him ſometimes to correct his own errors, and often to detect the errors of others; and he finds them of great uſe to confirm his judgment, to juſtify what is right, and to condemn what is wrong. Now mathematics are the nobleſt *praxis* of *logic*. Through them we may perceive how the ſtated forms of ſyllogiſm are exemplified in one ſubject, namely the predicament of quantity; and by marking the force of theſe forms, as they are there applied, we may be enabled to apply them of ourſelves elſewhere. Whoever, therefore, will ſtudy mathematics with this view, will become not only by mathematics a more expert *logician*, and by logic a more rational *mathematician*, but a wiſer philoſopher, and an acuter reaſoner, in all the poſſible ſubjects either of ſcience or deliberation. But when mathematics, inſtead of being applied to this ex-

cellent

[†] *Introduction to Julian*, &c.

[‡] *Appendix to Lord Kames's Sketch on the Principle and Progreſs of Reaſon.*

cellent purpoſe, are uſed not to exemplify logic, but to ſupply its place; no wonder if logic fall into contempt, and mathematics, inſtead of furthering ſcience, become in fact an obſtacle. For when men, knowing nothing of that reaſoning which is *univerſal*, come to attach themſelves for years to a *ſingle ſpecies*, a ſpecies wholly involved in *lines* and *numbers*, the mind becomes incapacitated for reaſoning at large, and eſpecially in the ſearch of *moral truth*. The object of mathematics is *demonſtration*; and whatever in that ſcience is not demonſtration, is nothing, or at leaſt below the ſublime inquirer's regard. *Probability*, through its almoſt infinite degrees, from ſimple ignorance up to abſolute certainty, is the *terra incognita* of the mathematician. And yet here it is that the great *buſineſs* of the human mind is carried on in the ſearch and diſcovery of all the important truths which concern us as reaſonable beings. And here too it is that all its *vigour* is exerted: for to proportion the aſſent to the probability accompanying every varying degree of moral evidence, requires the moſt enlarged and ſovereign exerciſe of reaſon.

In reaſonings of this kind, will any man pretend that it is of no uſe to be well acquainted with the various powers of the mind by which we reaſon? Is it of no uſe to reſolve the various kinds of reaſoning into their ſimple elements; and to diſcover, as far as we are able, the rules by which theſe elements are combined in judging and in reaſoning? Is it of no uſe to mark the various fallacies in reaſoning, by which even the moſt ingenious men have been led into error? It muſt ſurely betray great want of underſtanding, to think theſe things uſeleſs or unimportant. Now theſe are the things which logicians have attempted; and which they have executed—not indeed ſo completely as to leave no room for improvement, but in ſuch a manner as to give very conſiderable aid to our reaſoning powers. That the principles they have laid down with regard to definition, and diviſion, with regard to the converſion and oppoſition of propoſitions, and the general rules of reaſoning, are not without uſe, is ſufficiently apparent from the blunders committed daily by thoſe who diſdain any acquaintance with them.

Although the art of categorical ſyllogiſm is confeſſedly little fitted for the diſcovery of unknown truth, it may yet be employed to excellent purpoſes, as it is perhaps the moſt compendious method of detecting a fallacy. A man in queſt of unknown truths muſt generally proceed by the way of induction, from effects to cauſes; but he, who as a teacher is to inculcate any ſyſtem upon others, begins with one or more ſelf-evident truths, and proceeds in the way of demonſtration, to the concluſion which he wiſhes to eſtabliſh. Now every demonſtration, as has been already obſerved, may be reſolved into a ſeries of ſyllogiſms, of which the concluſion of the preceding always enters into the premiſes of that which follows: and if the firſt principles be clear and evident, and every ſyllogiſm in ſome legitimate mode and figure, the concluſion of the whole muſt infallibly be admitted. But when the demonſtration is thus broken into parts; if we find that the concluſion of one ſyllogiſm will not, without altering the meaning of the terms, enter legitimately into the premiſes of that which ſhould immediately follow; or, ſuppoſing it to make one of the premiſes of a *new* ſyllogiſm, if we find that the concluſion, reſulting from the whole ſeries *thus* obtained, is different from that of the demonſtration; we may, in either of theſe caſes, reſt aſſured that the author's reaſoning is fallacious, and leads to error; and that if it carried an appearance of conviction before it was thus reſolved into its elementary parts, it muſt have been owing to the inability of the mind to comprehend at *once* a long train of arguments. Whoever wiſhes to ſee the ſyllogiſtic art employed for this purpoſe, and to be convinced of the truth of what we have ſaid reſpecting its utility, may conſult the excellent writer recommended by Locke, who, in places innumerable of his incomparable book, has, without pedantry, even in that pedantic age, made the happieſt application of the rules of logic for unravelling the ſophiſtry of his Jeſuitical antagoniſt.

Upon the whole, then, though we readily acknowledge that much time was waſted by our fathers in ſyllogiſtic wrangling, and what might with little impropriety be termed the *mechanical* part of logic; yet the art of forming and examining arguments is certainly an attainment not unworthy the ambition of that being whoſe higheſt honour is to be endued with reaſon.

Logiſtæ, Logography.

LOGISTÆ, certain officers at Athens, in number ten, whoſe buſineſs conſiſted in receiving and paſſing the accounts of magiſtrates when they went out of office. The *logiſtæ* were elected by lot, and had ten *euthyni* or auditors of accounts under them.

LOGOGRAPHY, a new method of printing, in which the types, inſtead of anſwering only to ſingle letters, are made to correſpond to whole words.

This method, though ſeemingly a retrograde proceſſion in the printing art, has lately obtained the ſanction of his Britannic Majeſty's patent, and has for ſome time been actually put in execution in the way of trade, apparently with advantage to the proprietors. In the year 1783, a treatiſe upon this ſubject appeared by Henry Johnſon; in which the origin as well as the utility of the art are fully laid down, and the matter ſet forth in ſuch a light as can ſcarce allow us to doubt that it is an improvement in the art. Mr Johnſon informs us, that about five years before, viz. in the year 1778, intending to publiſh a daily liſt of blanks and prizes in the lottery numerically arranged, he found it could not be accompliſhed in time by the ordinary way of printing. On this account he procured types of two, three, or more figures as was neceſſary for his purpoſe; and thus any entire number might as readily be taken up as if it had been a ſingle type. His next attempt was in forming ſome large mercantile tables of pounds, ſhillings, pence, and farthings. For theſe he procured types expreſſive of any ſum of money ready compoſed and united, "by which

Logography.

which (ſays he) every ſpecies of figure-printing could be performed for the tenth part of the coſt, printers always charging it double the price of letter printing." Having thus ſucceeded to his wiſh in his two firſt attempts, he next began to conſider if the method could not be applied to words; and in this alſo the ſucceſs was equal.

The properties of the logographic art, according to our author, are, 1. That the compoſitor ſhall have leſs charged upon his memory than in the common way. 2. It is much leſs liable to error. 3. The type of each word is as eaſily laid hold of as that of a ſingle letter. 4. The decompoſition is much more readily performed, even by the mereſt novices, than they now decompoſe letters. 5. No extraordinary expence nor greater number of types is required in the logographic than in the common method of printing.

The firſt of theſe poſitions is proved by our author in the following manner. In the common method, the compoſitor has 150 diviſions to which there is no reference, and the printing offices are not agreed with reſpect to the mode of placing their boxes; "but under this improvement, he has only to know the letters of the alphabet, and is aſſiſted with an index of them, inſomuch that the ſimplicity of the latter apparatus enables him, by a little practice, to lay his finger almoſt blindfold on the word required; and the meaneſt capacity is equal to this mental exerciſe, having little more to do than knowing by inſpection the difference between words under three and thoſe above three ſyllables; and all the apparatus being within a compaſs not a great deal more extended than common printing, for theſe reaſons he is as ſoon poſſeſſed of his type of a word as they are of a ſingle letter."

Thus the firſt and third poſitions may be ſaid to be proved; but in his proof of the ſecond our author himſelf ſhows that his art is not infallible, by ſubſtituting the word *third* inſtead of *ſecond*. Subſtitutions of this kind, he owns, may readily take place; but ſuch errors are much more conſpicuous than literal ones, though they may be corrected with equal eaſe; "for the erroneous ſubſtitution cannot fail of being nearly equal in length to the word required; although, even otherwiſe, it would not be attended with greater diſadvantage than in the common way, and it would be rectified with greater facility.

The eaſe with which the compoſition is performed, ſhows that there muſt be an equal eaſe in performing the decompoſition; "from whence (ſays Mr Johnſon)" it is further demonſtrable, that any work can be compoſed by this method nearly as ſoon as it can be deliberately read; and as to the fifth poſition, that it ſhall not require a greater expence of types, it is anſwered, that it is impoſſible for more types of letters to be wanted for this method than by any other printer according to the equal quantity of buſineſs to be performed, every office having certain known quantities of each letter called a *fount*. A printer's fount contains about 92,500 letters, and our want is not more; nay, nearer the truth, the preſent quantity for a fount containing much more of ſome letters than neceſſary, and fewer of others; which ariſes from the calculation of the quantity of each letter wanted being adhered to ſince the old ſpelling.

Our author now proceeds to demonſtrate that the number of types muſt neceſſarily decreaſe as they are combined into ſyllables, and much more when formed into words. The whole art of arranging the words conſiſts in placing them under as few diviſions as poſſible, and ſtill fewer ſubdiviſions; which is attained by the following proceſs.

1. A collection of words, with the addition of tenſes, plurals, and degrees of compariſon, amounting to more than 100,000, was made from the beſt Engliſh Dictionaries.

2. Collections were made from the miſcellaneous part of 20 newſpapers, the Spectator, and Common Prayer-book. The method was, by procuring duplicates of every ſheet, ſo that each alternate ſide might be paſted over with white paper, in order to leave the whole of the words on both ſides perfect; and thus the whole might be touched with leſs danger of injury than otherwiſe could have been done. The confuſion ariſing from the parts of other words being ſeen from the oppoſite ſide was likewiſe prevented.

3. The words, being ſeparately cut out, were then put into a caſe marked with the diviſions from one to 16, according to the number of letters contained in each word. Thus ſeveral letters are diſtinctly collected; and then each ſeparate parcel ſorted in a caſe containing 26 diviſions marked with the letters of the alphabet, according to the commencing letter of the word; and thus all the words were ranged alphabetically, conſiſting of two, three, four, or five letters, in ſeparate parcels.

4. The ſame words were then placed together, and poſted into an alphabet, with the number of times marked to each that had occurred on the whole; that in this manner a proportion might be determined how many times particular words ought to be repeated for the printing of one ſheet, and alſo to know what words are in general uſe: There are likewiſe a number of technical terms, and favourite phraſes a great number of times repeated almoſt by every author, but though theſe occur throughout the whole book in great proportion to the reſt, no more of them will be neceſſary than what ſuffice for a ſingle ſheet.

5. The whole of the above might be done without the trouble juſt mentioned, by poſting every word at once into a triformed alphabet; becauſe the ſubdiviſions of the ſecond and third commencing letter of each word for references are now obtained, and thus can eaſily be placed in its proper diviſion, and may be marked as often as it occurs, without repeating the ſame word; whence we plainly ſee the eaſe and expedition of it from the facility and expedition of poſting every word from a leaf in any book. Before ſuch ſubdiviſions were known, they could only have been placed under the firſt commencing letter of the word; which would cauſe ſuch a multiplicity of repetitions, that it would take up more time, be far more liable to error, and require more ſubordinate poſtings to bring them into arrangement; ſo that they may be found more eaſily than by the above proceedings. Thus alſo a collection will be obtained of ſingle and double words, which are conſtantly required from 20 to 400 or 500 times in the printing one ſheet of any work whatever; and which alone would abridge the compoſitor's work near one-third. The ſecond proceſs

likewiſe enabled the author to reject, out of the firſt collection, obſolete words, technical terms, &c. which reduces the original collection to one fifth part.

6. By proceeding in this manner, ſeveral ſpecies of words are omitted in the founts. 1. Obſolete words; becauſe they occur ſo ſeldom, the difference of time loſt in compoſing them in the ordinary method would be imperceptible. 2. Technical terms names of places, animals, &c.; though, for any particular work, the terms peculiar to it may be added to the fount in a biformed alphabet apart. 3. Real compounds, or words that may be compounded of others, are alſo rejected; becauſe we actually have the words already, and they may be joined with ſufficient expedition, though the ſpaces are annexed to each, by being conſtructed accordingly. 4. Thoſe of the ſame ſpelling are likewiſe omitted, though they bear different ſignifications, for obvious reaſons.

7. The variation of tenſes, degrees of compariſon, and numerous words in the Engliſh language, having in general the ſame terminations, ſuch as ED, ING, LY, MENT, NESS, &c. an alphabet may be formed of ſuch a kind as is capable of being annexed to the abſolute words or radices, as expeditiouſly as the whole word could be found in the fount from its being thereby ſo much leſs extended. Thus, by dividing ſeveral words into their radices and terminations, many other words may be formed from the radix by the addition of various terminations, and each termination may be added to other radices to which they are applicable.

8. Some radices are imperfect, viz. ſuch as end with the vowel *e*, which muſt therefore be added in the uſual way of compoſition. Thus, in the word *adore*, the radix is *ador*, to which the terminations *es, ed, eſt, eth, er, ing*, may be added occaſionally.

9. By rejecting alſo the words which come under this laſt denomination, the number neceſſary for a fount is reduced to one-tenth of what it would otherwiſe be, as will appear evident from the following conſiderations: 1. There are at leaſt 42 verbs, the infinitive of which ends in *ify*; as *qualify, ſignify*; the radices of which are *qual, ſign:* the terminations are, *ifies, ified, ifiing*, &c. And Mr Johnſon informs us, that by applying theſe radices to other terminations, he was enabled to diſpenſe with more than 500 words which would otherwiſe have been neceſſary. 2. For all regular verbs, no more than ſix terminations are neceſſary, viz. *s, eſt, eth, ed, es ing*. There are but few irregular ones in the Engliſh language; whence it happens that 12 or 14 words may be formed from one ſingle perfect verb as a radix, and many imperfect ones ſave double that number.

10. By uſing only the ſet of terminations which may be contained in a box of two feet ſqure, the common operation of printing would be ſhortened nearly one half; and in order to find out thoſe which are moſt in uſe; and fitteſt to retain, our author digeſted them alphabetically, with the radices, words, or ſyllables which make complete words annexed to them. Thus,

$$\begin{array}{l}\text{tain}\\ \text{——s}\\ \text{——ed}\\ \text{——ing}\\ \text{——ment}\end{array}\left\}\begin{array}{l}\text{abs—apper—aſcer}\\ \text{de—dis—con}\\ \text{cer—cap—cur}\\ \text{enter—main—re—ſus, \&c.}\end{array}\right.$$

11. Thus it will be found, that out of more than 100,000 words of which the Engliſh language conſiſts, there will not be wanted much above 3500 for a complete fount. This will be very evident to any perſon who conſults a dictionary. He will there find, that a vaſt number of words require an explanation; whereas in any miſcellaneous work, there are none but what can be underſtood moſt readily either together or apart. Newſpapers retain more of the uncommon kind of words than any others. "The vocabulary (ſays our author) or alphabet as it is called, of the Chineſe, conſiſts of above 80,000 letters or characters; yet he is admitted a maſter of the language who knows about 4000 of them, no more being in general uſe."

The expedition with which the logographic method of printing can be accompliſhed, depends eſſentially on their arrangement; which, from great numbers of experiments, our author found to be beſt accompliſhed in the following manner; 1. Words of one, two, or three ſyllables are alphabetically placed by themſelves including all poſſible commencing ſyllables, by which the compoſitor cannot fail of finding the word either in whole or in part let it be what it will; and when the whole cannot be found at once, the remainder may eaſily be found in ſingle or double ſyllables among the terminations. 2. All words above three ſyllables have the ſame alphabetical arrangement; the terminations being the ſame at the bottom of each. Experience ſhows, that by a very few leſſons, the meaneſt capacity may determine the number of ſyllables, and refer to the particular caſe containing words of that number, there being conſpicuous references to each: and by thus equalizing them, any perſon may poſſeſs himſelf very expeditiouſly of what he wants. Even boys who ſcarce knew more than the letters of the alphabet were hardly a fortnight employed in this method, when they could at the firſt glance tell the number of letters contained in any word.

By this ſimplicity of arrangement, any intelligent perſon, who never compoſed in his life, by being placed in a room with the apparatus, could compoſe and print, without other previous inſtruction than deſiring him to remember that the words under three ſyllables, and thoſe above three are placed in ſeparate alphabets and that whenever he wants a word, the firſt letter is ſeen in capitals of two inches on the walls, the ſecond of letters of one inch in right lines; and where it is neceſſary to have more columns than one for ſuch ſecond letter, the third is given in red down the column, comprehending about 12 diviſions, to contain the types of the word coming under ſuch reference.

To exemplify this method as far as it can be done without actually ſeeing the apparatus, our author inſtances the two words *Above* and *Unfortunately*. In looking for the former, the firſt letter, A, is ſeen upon the wall as already mentioned; the ſecond, B, is on the caſe under it, and down that column is OVE, oppoſite to the cell containing the types of the whole words; which would be only three references inſtead of five with ſpaces; as in the common method. The other word, viz. *Unfortunately*, may be found by the ſame references, though it contains 13 letters; but "admitting that practice will give the word as ſoon as a ſingle letter, the average will be found eight for one."—our author's explanation of the method in which this word might be compoſed, however, ſeems by by no means intelligible.—“ For this diſtinction in the caſes (ſays he), the alphabet, or rather marks of firſt reference in large characters on the wall, is divided into two claſſes, not as vowels and conſonants, but as follows, *viz.* A, Con, Diſ, E, In, O, P, S, Un, commencing references, the ſecond or ſubſequent letters of the words being in a right line from left to right, and down each column is found the remainder of the reference to the words, diſtinguiſhing always the third letter in red. The ſecond diſtinction is, that for all other commencing letters, the ſecond letter of reference is in a column down, and the third letter in lines from left to right in red.

Theſe are the directions given by our author for forming a fount of words; the next requiſite is a fount of ſyllables, formed in the following method: 1. A complete ſet of two letters was obtained in all their poſſible combinations, amounting to 676. 2. Having next obtained the poſſible combination of theſe letters, *viz.* 17576, by retaining only all poſſible ſyllables, and words of three letters, it is reduced to the 30th part, which anſwer all the purpoſes of compoſing with ſyllables, of two and three letters, for Latin, French, Engliſh, and all names of perſons, places, and things every poſſible ſyllable being comprehended among them. Hence it forms an univerſal triformed alphabet, where Engliſh characters are uſed; from whence all partial biformed and triformed alphabets in the arrangement of Engliſh, French, Latin, and all technical matters, are drawn. Though combinations of four letters are again 26 times the number of thoſe of three letters, and five letters increaſe in the ſame ratio; yet as much as all poſſible combinations increaſe in quantity proportionate to the number of letters combined ſo they decreaſe in the actual number of ſyllables included among them, inſomuch that all the ſyllables of four, five, ſix, and ſeven letters together, are conſiderably fewer than the ſyllables of three letters only.—Beſides the two founts already mentioned, a third was found neceſſary for ſuch terminations as are moſt commonly followed by particular punctuations; but, after ſome conſideration, this was judged unneceſſary.

Our author now proceeds to obviate ſome objections which muſt naturally occur to one who firſt hears of his invention. Theſe are,

1. a ſingle letter damaged in a word renders the whole uſeleſs.

This is not denied by Mr Johnſon; but he contends, that the quantity of metal loſt in this manner is quite trifling.

2. How are the blanks or ſpaces in a line to be managed, as theſe are by no means equal.

To this our author replies, that, at the time of writing the pamphlet, he was undetermined whether it be moſt eligible to have ſpaces caſt along with the beginnings of words, or to ſpace them in the common manner. The former would be more expeditious; and where a greater diſtance is required, other ſpaces may be introduced in the ordinary method.

3. How is a long word at the end of a line to be divided?

This may be eaſily accompliſhed by means of the ſyllabic fount already mentioned.

4. How is the error of ſubſtituting one word for another to be rectified?

The anſwer to this is, that an error of the kind ſpecified may be corrected in the very ſame manner as is done in common printing. Long words may be divided by means of the ſyllabic fount already mentioned and the intervals between the words may be filled up with *ſpaces* as uſual.

LOGWOOD. See Hæmatoxylon.

LOHOCH, or Loch, in pharmacy a compoſition of a middle conſiſtence between a ſoft electuary and a ſyrup, principally uſed in diſorders of the lungs.

LOINS, in anatomy, the two lateral parts of the umbilical region of the abdomen.

LOIRE, the largeſt river in France, riſes in the mountain of the Cevennes, and, after running a courſe of about 550 miles, falls into the bay of Biſcay.

LOKE, in mythology, the name of one of the deities of the northern nations, anſwering to the Arimanes among the Perſians, whom they repreſent as at enmity both with gods and men, and the author of all the evils which deſolate the univerſe. Loke is deſcribed in the edda as producing the great ſerpent which incircles the world: which ſeems to have been intended as an emblem of corruption or ſin: he alſo gives birth to Hela or death, the queen of the infernal regions; and alſo to the wolf Fenris, that monſter who is to encounter the gods and deſtroy the world.

LOKMAN the Wise, an eminent philoſopher among the eaſterns. The Arabians ſay he was the ſon of Bauran, the ſon or grandſon of a ſiſter or aunt of Job. He was an Ethiopian, and a ſlave for ſome time. It is related that he was born in the time of David, and lived till the age of the prophet Jonas. Some ſuppoſe him to have been the ſame with Æſop the mythologiſt; and indeed we find in the parables or apologues of Lokman in Arabic, many particulars that are ſeen in Æſop's fables: ſo that it is not eaſy to determine whether the Greek or the Arabian are the originals. He is ſaid to have been deformed in his perſon; but that this defect was ſufficiently made up by the perfections of his mind. Some pieces of his are extant; and he was looked upon as ſo excellent a perſon, that Mahomet has inſerted a chapter of the Koran, called after his name, in which he introduces God as ſaying, “ We heretofore beſtowed wiſdom on Lokman.”—It is related that he got his liberty on the following occaſion. His maſter having given him a bitter melon to eat he eat it all. His maſter, ſurpriſed at his exact obedience, aſked, how it was poſſible for him to eat ſuch a nauſeous fruit? He anſwered, “ I have received ſo many favours from you, that it is no wonder I ſhould once in my life eat a bitter melon from your hand.” This generous anſwer of the ſlave ſtruck the maſter to ſuch a degree, that he immediately gave him his liberty. M. Galland tranſlated all the fables of Lokman, and Bidpai or Pilpay a bramin philoſopher, which were publiſhed at Paris in 1724.

LOLIUM, darnell-grass, in botany: A genus of the dygynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 4th order, *Gramina.* The calyx is monophyllous fixed, and uniflorous. The moſt remarkable ſpecies are, 1. The perenne, red darnel, or rye-graſs. This is very common in roads and dry paſtures. It makes excellent hay upon dry chalky, or ſandy ſoils. It is advantageouſly cultivated along with clover, and ſprings

ſprings earlier than other graſſes; thereby ſupplying food for cattle at a time when it is moſt difficult to be obtained. Cows, horſes, and ſheep eat it; goats are not fond of it. 2. The temulentum, or white darnel grows ſpontaneouſly in ploughed fields. If the ſeeds of this ſpecies are malted with barley, the ale ſoon occaſions drunkenneſs: mixed with bread-corn, they produce but little effect unleſs the bread is eaten hot.

LOLLARDS, in eccleſiaſtical hiſtory, a religious ſect, differing in many religious points from the church of Rome, which aroſe in Germany about the beginning of the 14th century; ſo called, as many writers have imagined, from Walter Lollard, who began to dogmatiſe in 1315, and was burnt at Cologn: though others think that Lollard, was no ſurname, but merely a term of reproach applied to all heretics who concealed the poiſon of error under the appearances of piety.

The monk of Canterbury derives the origin of the word Lollards among us, from *lolium*, "a tare" as if the Lollards were the tares ſown in Chriſt's vineyard. Abelly ſays, that the word Lollard ſignifies "praiſing God," from the German *loben*, "to praiſe," and *herr* "Lord:" becauſe the Lollards employed themſelves in travelling about from place to place, ſinging pſalms and hymns.

Others, much to the ſame purpoſe, derive *lollhard*, *lullhard*, or *lollert*, *lullert*, as it was written by the ancient Germans from the old German word *lullen*, *lollen*, or *lallen*, and the termination *hard*, with which many of the High Dutch words end. *Lollen* ſignifies "to ſing with a low voice," and therefore Lollard is a ſinger or one who frequently ſings; and in the vulgar tongue of the Germans it denotes a perſon who is continually praiſing God with a ſong, or ſinging hymns to his honour. The Alexians or Cellites were called *Lollards*, becauſe they were public ſingers who made it their buſineſs to inter the bodies of thoſe who died of the plague, and ſang a dirge over them in a mournful and indiſtinct tone as they carried them to the grave. The name was afterwards aſſumed by perſons that diſhonoured it; for we find among thoſe Lollards who made extraordinary pretences to piety and religion, and ſpent the greateſt part of their time in meditation, prayer, and ſuch acts of piety, there were many abominable hypocrites, who entertained the moſt ridiculous opinions and concealed the moſt enormous vices under the ſpecious mark of this extraordinary profeſſion. And many injurious aſperſions were propagated againſt thoſe who aſſumed that name by the prieſts and monks; ſo that by degrees, any perſon who covered hereſies or crimes under the appearance of piety, was called a *Lollard*. Thus the name was not uſed to denote any one particular ſect, but was formerly common to all perſons and all ſects who were ſuppoſed to be guilty of impiety towards God or the church, under the external profeſſion of extraordinary piety. However, many ſocieties, conſiſting both of men and women under the name of *Lollords*, were formed in moſt parts of Germany and Flanders, and were ſupported partly by their manual labours, and partly by the charitable donations of pious perſons. The magiſtrates and inhabitants of the towns where theſe brethren and ſiſters reſided, gave them particular marks of favour and protection, on account of their great uſefulneſs to the ſick and needy. They were thus ſupported againſt their malignant rivals, and obtained many papal conſtitutions by which their inſtitute was confirmed, their perſons exempted from the cogniſance of the inquiſitors, and ſubjected entirely to the juriſdiction of the biſhops; but as theſe meaſures were inſufficient to ſecure them from moleſtation, Charles duke of Burgundy, in the year 1472, obtained a ſolemn bull from Pope Sixtus IV. ordering that the Cellites or Lollards ſhould be ranked among the religious orders, and delivered from the juriſdiction of the biſhops; and Pope Julius II. granted them yet greater privileges in the year 1506. Moſheim informs us that many ſocieties of this kind are ſtill ſubſiſting at Cologn, and in the cities of Flanders, though they have evidently departed from their ancient rules.

Lollard and his followers rejected the ſacrifice of the maſs, extreme unction, and penances for ſin; arguing, that Chriſt's ſufferings were ſufficient. He is likewiſe ſaid to have ſet aſide baptiſm, as a thing of no effect; and repentance, as not abſolutely neceſſary, &c.—In England, the followers of Wickliffe were called, by way of reproach, *Lollards, from* ſome affinity there was between ſome of their tenets; though others are of opinion that the Engliſh Lollards came from Germany.

They were ſolemnly condemned by the archbiſhop of Canterbury and the council of Oxford.

LOMBARD (Lambert), an eminent painter, born at Leige in 1500; who after a diligent ſtudy of the antique at Rome, introduced that ſtyle of painting among his countrymen inſtead of the Gothic. He painted hiſtory, architecture, and perſpective; and though he could never altogether free himſelf from his national goût, he is ranked among the beſt painters of his time. He died in 1560.

Lombard (Peter), well known by the title of *Maſter of the Sentences*, was born at Novara in Lombardy; but being bred at Paris, he diſtinguiſhed himſelf ſo much at that univerſity, that he firſt had the canonry of Chartres conferred on him, was ſome time tutor to Philip ſon of Louis le Gros, and laſtly obtained the ſee of Paris. He died in 1064. His work of the ſentences is looked on as the ſource of the ſcholaſtic theology of the Latin church. He wrote alſo commentaries on the Pſalms, and on St Paul's Epiſtles.

LOMBARDS, a Scandinavian nation, who formerly ſettled in Italy, and for ſome time made a conſiderable figure.

1 Etymology of the name.

Their name of *Lombards*, or *Longobards*, is by ſome derived from the word *lack*, or *lache*, ſignifying in the German tongue *winter*; becauſe the Lombards, while in Scandinavia, lived in marſhes or near the ſea. Others thinks that it comes from the two German words *langen bardon*, or *helleborden*, that is from the long halberts they were ſuppoſed to uſe in war. But Paulus Diaconus their hiſtorian, and was himſelf a Lombard, tells us, that they were called *Longobards* from the length of of their beards. A nation called the *lombards* is mentioned by Tacitus, Strabo, and Ptolemy; but theſe are different from the Lombards who afterwards ſettled in Italy, and are reckoned to be the ſame with the Gepidæ, whom the Italian Lombards almoſt exterminated. The Lombards who ſettled in Italy are firſt mentioned by Proſper Aquitanus, biſhop of Rhegium in the year 379. That writer tells us, that about this time the Lombards, abandoning the moſt diſtant coaſts of the ocean and their native country Scandinavia, and ſeeking for new ſettlements, as they were overſtocked with people at home, firſt attacked and overcame about this time the Vandals in Germany. They were then headed by two chiefs, Iboreus and Aion who, dying about the year 389, were ſucceeded by Agilmund, who is commonly reckoned the firſt king of the Lombards.

2 Vandals defeated by the Lombards.

Before the time of Odoacer, the Lombard hiſtory affords nothing remarkable; in his time, however, they ſettled on the Danube, in the country of the Rugians, whom Odoacer had almoſt totally exterminated or carried into captivity. During their ſtay in this country, they rendered themſelves formidable to the neighbouring nations, and carried on ſucceſsful wars with the Heruli and Gepidæ. In 526, they were allowed by the emperor Juſtinian to ſettle in Pannonia; and here they made war a ſecond time with the Gepidæ. Alboinus, the Lombard king, killed the king of the Gepidæ with his own hand, put his army to the rout, and cut ſuch numbers of them in pieces, that they ceaſed from that time to be a nation. Having cauſed the deceaſed king's head to be cut off, he made a cup of his ſkull, called in the language of the Lombards *ſchala*, which he made uſe of in all public entertainments. However having taken among many other captives of great diſtinction, the late king's daughter, by name *Roſamunda*, he married her after the death of his former wife Clodiſvinta, the daughter of Clotaire king of France.

3 They ſettle in the country of the Rugians.

4 Deſtroy the Gepidæ.

By this victory Alboinus gained ſuch reputation, that his friendſhip was courted by Juſtinian; and, in conſequence of the emperor's application, a body of 6000 Lombards were ſent to the aſſiſtance of Narſes againſt the Goths. The ſucceſs of the Romans in this expedition, the invaſion of Italy by the Lombards and their ſucceſſes in that country, have been taken notice of under the article Italy, n° 28—32. At laſt Alboinus, having made himſelf maſter of Venetia, Liguria, Æmilia, Hetruria, and Umbria, was ſlain by the treachery of his wife, in the year 575, the fourth of his reign. This princeſs was the daughter of the king of the Gepidæ, whom Alboinus had killed in battle and made a cup of his ſkull as above related. As he was one day feaſting at Verona with his chief favourites and principal officers, in the height of his mirth he ſent for the queen, and filling the deteſted cup, commanded her to drink merrily with her father. Roſamund ſtruck with horror, hurried out of the room; and highly incenſed againſt her huſband for thus barbariouſly triumphing over the misfortunes of her family, reſolved at all events, to make him pay dear from ſuch an inhuman and affronting conduct. Accordingly, ſhe diſcovering her intention to Helmichild the kings ſhield-bearer, a youth of great boldneſs and intrepidity. Helmichild peremptorily refuſed to imbrue his hands in the blood of his ſovereign, or to be any way acceſſory to his death; and in this reſolution he perſiſted till he was, by a ſhameful ſtratagem, forced by the queen to a compliance: for ſhe, knowing that he carried on an intrigue with one of her ladies, placed herſelf one night in her bed, and receiving the youth, indulged him as if ſhe had been his own miſtreſs in his amorous deſires; which ſhe had no ſooner done, than diſcovering herſelf to the deceived lover, ſhe told him that he muſt now either put the king to death, or be put to death by him. Helmichild, well appriſed, that after what he had done, his ſafety depended on the death of the king, engaged in the treaſon, which he otherwiſe abhorred. One day, therefore, while Alboinus was repoſing in his chamber after dinner, Helmichild, with ſome others whom he had made privy to his deſigh, breaking in unexpectedly fell upon the king with their daggers. Alboinus, ſtarting up at their firſt coming in, laid hold of his ſword, which he had always by him; but having in vain attempted to draw it, the queen having beforehand faſtened it in the ſcabbard, he defended himſelf for ſome time with a footſtool; but was in the end overpowered, and diſpatched with many wounds.

5 Alboinus king of the Lombards aſſaſſinated at the inſtigation of his wife.

Roſamund had promiſed to Helmichild, that, as ſoon as he had diſpatched the king, ſhe would marry him, and with her perſon, beſtow upon him the kingdom of the Lombards. The firſt part of her promiſe ſhe immediately performed; but was ſo far from being able to beſtow the crown upon him, that both of them were obliged to ſave themſelves by flight. They fled to Longinus the exarch of Ravenna, taking with them all the jewels and treaſure of the late king. Longinus received her with the greateſt marks of friendſhip and kindneſs, and aſſured her of his protection. She had not been long in Ravenna, however, before the exarch, judging that a favourable opportunity now offered of making himſelf king of Italy by her means, imparted his deſign to her, and declared his intention to marry her, provided, by ſome means or other, ſhe diſpatched Helmichild.—Roſamund, highly pleaſed with the propoſal, reſolved to ſatisfy her ambition by getting rid of the perſon whom ſhe had married in order to gratify her revenge. Accordingly, having prepared a ſtrong poiſon, ſhe mixed it with wine, and gave it to her huſband as he came out of the bath and called for drink, according to his cuſtom. Helmichild had not half emptied the cup when by the ſudden and ſtrange operation which he felt in his bowels, he conclued what it was, and, with his ſword pointed at the queen's breaſt, compelled her to drink the reſt. The poiſon had the ſame effect on both; for they died in a few hours. Longinus, on the death of the queen, laid aſide all thoughts of making himſelf king of Italy, and ſent the king's treaſure to Conſtantinople, together with Albiſoinda the daughter of Alboinus by Roſamund, whom ſhe had brought along with her.

6 Her death.

After the death of Alboinus, the Lombards choſe Clephis, one of the nobility for their king. He was murdered after a ſhort reign of 18 months; upon which enſued an interregnum of 10 years, as related under the article Italy, n° 32. During this time, they extended their conqueſts in that country; but at laſt the Romans, jealous of their progreſs, reſolved to put a ſtop to their victories, and, if poſſible to drive them quite out. For this purpoſe, they deſigned not only to employ their own force, but entered into alliance with the Franks; which ſo alarmed the Lombards, that they re-eſtabliſhed the monarchial form of go-

7 Monarchy aboliſhed.

8 Reſtored.

vernment among themſelves, and choſe Autharis the ſon of Clephis for their king. This monarch, conſidering that the power of the dukes, who had governed Lombardy for the ſpace of 10 years, was during that length of time very much eſtabliſhed, and that they would not probably be willing to part with the authority which they had ſo long enjoyed, allowed them to continue in their government; but obliged them to contribute one moiety of their revenues towards the maintenence and ſupport of his royal dignity, ſuffering them to diſpoſe of the other as they thought proper. He reſerved to himſelf the ſupreme dominion and authority: and took an oath of the dukes, that, in time of war, they would readily aſſiſt him to the utmoſt of their power. Though he could remove the dukes at pleaſure, yet he deprived none of them of their dukedoms, except in caſes of treaſon: nor gave them to others, except when their male iſſue failed. Having ſettled matters in this manner with the dukes, he enacted ſeveral wholeſome laws againſt theft, rapine, murder, adultery, and other vices which prevailed among his ſubjects, and was the firſt of the Lombard kings who embraced Chriſtianity. Moſt of his ſubjects followed the example of their monarch; but as they were all inſtructed by Arian biſhops, they continued long infected with that hereſy; which occaſioned great diſputes between them and the orthodox biſhops of the cities ſubject to them.

9 Written laws when firſt introduced.

From the re-eſtabliſhment of the monarchy under Autharis, to the reign of Rotharis in 636, the hiſtory of the Lombards affords nothing memorable. This period is remarkable for the introduction of written laws among theſe people. Before his time they had been governed only by tradition; but Rotharis, in imitation of the Romans and Goths, undertook the publiſhing of written laws; and to thoſe which he enacted many were added by the ſucceeding princes. Grotius prefers the method which the Lombards followed in making laws, to that which was practiſed by the Romans themſelves. Among the latter the emperor was the ſole lawgiver; ſo that whatever pleaſed him had the force of a law. But the Lombard kings did not aſſume that power to themſelves, ſince their laws were enacted in public aſſemblies, convened for that purpoſe after they had been maturely examined and approved of by all the lords of the kingdom. From theſe aſſemblies were excluded the eccleſiaſtic order, and the people; ſo that the legiſlative power was lodged in the king and nobles alone.

10 Luitprand's ambition.

The reign of Rotharis is remarkable, not only for his introducing written laws among his ſubjects, but for the conqueſts he made, and the ſucceſsful wars carried on with the exarch of Ravenna, whom he totally defeated in ſeveral engagements, and made himſelf maſter of ſome part of his territories. This monarch died in 652; and the affairs of the Lombards went on proſperouſly, till the ambition of Luitprand laid the foundation of the total ruin of his kingdom. He aſcended the throne of Lombardy in 711, and watched all opportunities of enlarging his dominions at the expence of the emperors. Of this, a fair opportunity offered in 716: for the emperor Leo Iſauricus, who at that time reigned in the eaſt, having, by his famous edict, forbidden the worſhip of images, and ordered them to be every where pulled down, the people were ſo provoked at that innovation, that, in ſeveral places, they openly revolted, and, falling upon the emperor's officers, drove them out of the cities. In the eaſt, Germanus, patriarch of Conſtantinople, oppoſed the emperor's deſign with great warmth; but Leo cauſed him to be depoſed, and Anaſtaſius to be raiſed to that ſee in his room, ordering, at the ſame time all the images in the imperial city to be pulled down and publilcly burnt. He ſtrictly enjoined his officers in the weſt, eſpecially the exarch of Ravenna, to ſee his edict punctually obeyed in their reſpective governments. In compliance with theſe orders, Scholaſticus, then exarch, began to pull down the images in all the churches and public places in Ravenna; which incenſed the ſuperſtitious multitude to ſuch a degree, that, taking arms, they openly declared they would rather renounce their allegiance to the emperor than the worſhip of images.

11 He beſieges and at laſt takes Ravenna.

12 Reduces the exarchate to a dukedom.

Thus a kind of civil war being kindled in the city, Luitprand thought he had now a favourable opportunity of making himſelf maſter of the ſeat of the exarch, not doubting but the conqueſt of ſuch an important place would be followed by that of the whole exarchate. Having therefore drawn together all his forces, he unexpectedly appeared before Ravenna, and cloſely beſieged it. The exarch little expected ſuch a ſurpriſe, as a friendly correſpondence had been maintained for many years between the exarchs and the Lombard kings. However, he defended the place with ſuch courage and reſolution, that Luitprand, deſpairing of ſucceſs, broke up the ſiege, and led his army againſt Claſſis, at a ſmall diſtance from Ravenna, which he took, plundered, and levelled with the ground. The loſs of this place, and the ſevere treatment the inhabitants met with from the king, threw the citizens of Ravenna into the utmoſt conſternation; which Luitprand being informed of, he reſolved to take advantage of their fears, and, returning before Ravenna while the inhabitants were thus diſheartened to attempt once more the reduction of that place. Accordingly he led his whole army againſt it, and, by frequent attacks, tired the inhabitants and garriſon to ſuch a degree, that the exarch, finding they could hold out no longer and deſpairing of relief, privately withdrew. Luitprand, informed of his retreat, attacked the town with more violence than ever; and, having carried it by ſtorm, gave it up to be plundered by his ſoldiers, who found in it an immenſe booty, as it had been for a long time the ſeat of the Roman emperors, of the Gothic kings, and the exarchs. The king ſtripped it of moſt of its valuable monuments of antiquity, and cauſed, among the reſt, an equeſtrian ſtatue of an emperor, of wonderful workmanſhip, to be conveyed to Pavia, where it is to be ſeen to this day. The reduction of Ravenna was followed by the ſurrender of ſeveral cities of the exarchate, which Luitprand reduced to a dukedom; appointing Hildebrand his grandſon to govern it with the title of duke; and giving him, as he was yet an infant, Peredeus duke of Vicenza for his guardian.

The conqueſt of Ravenna and the greater part of the exarchate did not a little alarm Gregory II. biſhop of Rome. He was then at variance with the emperor, whoſe edict againſt the worſhipping of images he had oppoſed with all his might, and by that means provoked Leo to ſuch a degree, that he had threatened to drive him from the ſee, and ſend him into exile. However, the pope, no leſs jealous of the power of the Lombards than all his predeceſſors had been, reſolved, by ſome means or other, to put a ſtop to their conqueſts. The only prince in Italy to whom he could have recourſe was Urſus, duke of Venice, the Venetians making already no inconſiderable figure.

13 The exarch aſſiſted by the Venetians.

To him accordingly he wrote a very preſſing letter; conjuring him to aſſiſt his worthy ſon the exarch, and for the love of the holy faith, to attempt with him the recovery of the exarchate, which the wicked nation of the Lombards had unjuſtly taken from his ſons Leo and Conſtantine emperors. Urſus and the Venetians, moved with the pope's letter, and at the ſame time greatly alarmed at the growth of ſo powerful a neighbour, promiſed to aſſiſt the exarch with the whole ſtrength of their republic; and accordingly fitted out a conſiderable fleet, pretending it was deſigned for the ſervice of the emperor againſt the Saracens. At the ſame time the exarch, who had taken refuge in Venice, abandoning that place, as it were in deſpair of bringing the duke over to his party, raiſed, in the places ſtill ſubject to the emperor, what forces he was able; and having got together a conſiderable body, he marched with them towards Imola, giving out that he deſigned to beſiege that city; but, turning on a ſudden towards Ravenna, as had been agreed on between him and the Venetians, he laid ſiege to it by land, while they inveſted it almoſt at the ſame inſtant by ſea. Peredeus defended the town for ſome time with great courage and reſolution; obliging all thoſe who were able to bear arms to repair to the walls.

14 Who retake Ravenna.

But the Venetians having, in ſpite of all oppoſition, forced open one of the gates on the ſide of the ſea, the city was taken, and Peredeus ſlain, while he was attempting, at the head of a choice body, to drive the enemy from the poſts they had ſeized. As for Hildebrand, he fell into the hands of the Venetians; who, having thus recovered Ravenna to the emperor, returned home, leaving the exarch in the poſſeſſion of the city. Luitprand was then at Pavia; but the town was taken before he could aſſemble his troops to relieve it.

And now Gregory biſhop of Rome, to whom the recovery of Ravenna was chiefly owing, perſuading himſelf, that the emperor would, out of gratitude, give ear to his remonſtrances and admonitions, began to ſolicit him with more preſſing letters than ever to revoke his edict againſt the worſhip of images: but Leo, well appriſed that the biſhop, in all the meaſures he had taken, had been more influenced by a regard to his own intereſt, than to that of the empire, inſtead of hearkening to his remonſtrances, was ſtill more provoked againſt him for thus obſtinately oppoſing the execution of his edict. Being, therefore, reſolved at all events to have it obſerved in Rome itſelf, and, on the other hand, not doubting but the pope would oppoſe it to the laſt with all his might; in order to remove all obſtacles, he ſent three officers to Rome, with private orders either to diſpatch the pope, or to take him priſoner and convey him to Conſtantinople. At the ſame time he wrote to Mauritius duke of Rome, ſecretly enjoining him to aſſiſt his three officers, in their undertaking: but no favourable opportunity offering to put their deſign in execution, the emperor, in the year 725, recalled Scholaſticus, and ſent Paul a patrician into Italy, to govern in his room, with private inſtructions to encourage the abovementioned officers with the promiſe of great rewards, and to aſſure them of his protection.

But, in the mean time the plot was diſcovered, and two of the conſpirators were apprehended by the citizens of Rome, and put to death; the third having eſcaped into a monaſtery, where he took the monaſtic habit, and ended his days. Hereupon the exarch, in compliance with the emperor's orders, reſolved to proceed no longer by ſecret plots, but by open force. Accordingly, he drew together a conſiderable body of troops, and ſet out at the head of them on his march to Rome, with a deſign to ſeize on the pope, and ſend him, as he had engaged to do, in chains to Conſtantinople.

15 Luitprand aſſiſts the pope againſt the exarch.

But on this occaſion, Luitprand, though highly provoked againſt Gregory for having ſtirred up the Venetians againſt him, yet reſolved to aſſiſt him and the citizens of Rome againſt the exarch, in order to keep the balance even between them, and by aſſiſting ſometimes the one and ſometimes the other, weaken both. Purſuant to this reſolution, he ordered the Lombards of Tuſcany, and thoſe of the dukedom of Spoleto, to join the pope and the inhabitants of Rome; who, being by this reinforcement far ſuperior in ſtrength and number to the exarch, obliged him to return to Ravenna, and give over all thoughts of any further attempt on the perſon of the pope.

In the mean time, Leo, perſiſting in his former reſolution of ſuppreſſing throughout his dominions the worſhip of images, ſent freſh orders to the exarch Paul, ſtrictly enjoining him to cauſe his edict to be put in execution in all the cities of Italy under his empire, eſpecially in Rome. At the ſame time he wrote to the pope, promiſing him his favour and protection if he complied with the edict; and declaring him, if he continued to oppoſe it, a rebel, and no longer veſted with the papal dignity. But Gregory was ſo far from yielding to the emperor's threats or promiſes, that, on the contrary, he ſolemnly excommunicated the exarch for attempting to put the imperial edict in execution; and at the ſame time wrote circular letters to the Venetians, to king Luitprand, to the Lombard dukes, and to all the chief cities of the empire, exhorting them to continue ſtedfaſt in the Catholic faith, and to oppoſe with all their might ſuch a deteſtable innovation. Theſe letters made ſuch an impreſſion on the minds of the people of Italy, that, though of different intereſts, and often at war with one another, they all united; proteſting they would defend the Catholic faith, and the life of the pope in ſo glorious a cauſe, at the expence of their own; nay, the citizens of Rome, and the inhabitants of Pentapolis, now Marca d'Ancona, not contenting themſelves with ſuch a proteſtation, openly revolted from the emperor; and, pulling down his ſtatues, they elected, by their own authority, magiſtrates to govern them during the interregnum. We are even told, that, tranſported with a blind zeal, they were for chooſing a new emperor, and conducting him to Conſtantinople, not doubting but the people would every where join them. But the pope, thinking this reſolution unſeaſonable, and not to be eaſily put in execution, oppoſed it; ſo that it did not take place.

In the mean time, the exarch Paul, having gained a conſiderable party in Ravenna, began, purſuant to the repeated orders from the emperor, to remove the images, as ſo many idols, out of the churches. Hereupon the adverſe party, ſupported and encouraged by the pope, flew to arms; and, falling upon the *iconoclaſts* or image-breakers, as they ſtyled them, gave riſe to a civil war within the walls of Ravenna. Great numbers were killed on both ſides: but thoſe who were for the worſhip of images prevailing in the end, a dreadful ſlaughter was made of the oppoſite party; and, among the reſt, the exarch himſelf was murdered. However, the city of Ravenna continued faithful to the emperor; the moſt of the cities of Romagna belonging to the exarchate, and all thoſe of Pentapolis or La Marca d'Ancona, abhorring the emperor as an heretic, ſubmitted to Luitprand king of the Lombards; who pretending a zeal for the Catholic religion, took care to improve the diſcontent of the people to his advantage, by repreſenting to them that they could never maintain their religious rights under a prince, who was not only an heretic, but a perſecutor of the orthodox.

16 A civil war in Ravenna.

In Naples, Exhilaratus, duke of that city, having received peremptory orders from the emperor to cauſe his edict to be put in execution, did all that lay in his power to perſuade the people to receive it; but finding all his endeavours thwarted by the biſhop of Rome, for whom the Neapolitans had a great veneration, he hired aſſaſſins to murder him. But the plot being diſcovered, though carried on with great ſecrecy, the Neapolitans, highly provoked againſt the duke, tore both him and his ſon to pieces, and likewiſe put to death one of his chief officers, who had compoſed a libel againſt the pope. Luitprand, and Gregory at that time duke of Benevento, laying hold of ſo favourable an opportunity to make themſelves maſters of the dukedom of Naples, did all that lay in their power to perſuade the Neapolitans to ſubmit to them. But the Neapolitans, bearing an irreconcileable hatred to the Lombards, with whom they had been conſtantly at variance, rejected every overture of that nature with the utmoſt indignation; and, continuing ſtedfaſt in their allegiance to Leo, received from Conſtantinople one Peter, who was ſent to govern them in the room of Exhilaratus. Some writers ſuppoſe the Neapolitans, in this general revolt of the cities of Italy, to have ſhaken off the yoke with the reſt, and to have appointed magiſtrates of their own election to govern them in the room of the officers hitherto ſent from Conſtantinople, or named by the exarch: but they are certainly miſtaken; it being manifeſt from hiſtory, that Peter ſucceeded Exhilaratus in that dukedom, and that the Neapolitans continued to live under the emperors, till they were conquered many years after by the Normans.

In the mean time, Leo hearing of the murder of the exarch, and the general revolt of the cities, and not doubting but the pope was the chief author of ſo much miſchief, ſent the eunuch Eutychius into Italy, with the title and authority of *exarch*, ſtrictly enjoining him to get the pope diſpatched by ſome means or other, ſince his death was abſolutely neceſſary for the tranquillity of Italy. The exarch ſpared no pains to get the pope into his power: but a meſſenger, whom he had ſent to Rome, being apprehended by the citizens, and an order from the emperor being found upon him to all his officers in that city commanding them to put the pope to death at all events, the pope's friends thenceforth guarded him with ſuch care, that the exarch's emiſſaries could never afterwards find an opportunity of executing their deſign. As for the meſſenger, the Romans were for putting him to death; but the pope interpoſed, contenting himſelf with excommunicating the exarch.

17 The Romans revolt.

And now the Romans, provoked more than ever againſt Leo, and, on the other hand, unwilling to live under the Lombards, reſolved to revolt from the emperor, and appoint their own magiſtrates, keeping themſelves united under the pope, not yet as their prince, but only as their head. This they did accordingly; and from theſe ſlender beginnings the ſovereignty of the popes in Italy took its riſe, though they did not then, as is commonly ſuppoſed by hiſtorians, but many years after, become ſovereign lords of Rome.

Eutychius failed in his deſign upon the life of the pope; but having brought with him from Conſtantinople a good number of troops, he eaſily quelled the rebellion in Ravenna, and ſeverely puniſhed the authors of the late diſturbances. As for the rebellious Romans, he was well appriſed he could never reduce them, ſo long as they were ſupported by the king of the Lombards; and therefore he employed all his art and policy to take off that prince from the party of the Romans, and bring him over to his own.

18 Luitprand concludes an alliance with the exarch.

Luitprand, for ſome time, withſtood all his offers; but Thraſimund duke of Spoleto revolting at this very juncture, the exarch, laying hold of that opportunity, offered to aſſiſt the king with all his ſtrength againſt the rebellious duke, provided he would, in like manner, aſſiſt him againſt the pope and the Romans. With this propoſal Luitprand readily cloſed; and a league being concluded upon theſe terms between him and the exarch, the two armies joined, and began their march towards Spoleto. At their approach, the duke, deſpairing of being able to reſiſt two ſuch powers, came out with a ſmall attendance to meet them, and, throwing himſelf at the king's feet, ſued, in that humble poſture, for pardon; which Luitprand not only granted him, but confirmed him in the dukedom, after he had obliged him to take a new oath of allegiance, and give hoſtages for his fidelity in time to come. From Spoleto, the two armies marched, in purſuance of the treaty, to Rome; and encamped in the meadows of Nero, between the Tiber and the Vatican.

19 The pope ſubmits to Luitprand.

Gregory had cauſed the city of Rome to be fortified in the beſt manner he could: but being ſenſible that the Romans alone could not long hold out againſt two ſuch armies, and reflecting on the kind treatment the duke of Spoleto had met with upon his ſubmitting to the king, he reſolved to follow his example; and accordingly, taking with him ſome of the clergy, and the principal inhabitants of the city, he went to wait on the king in his camp; and there, with a pathetic ſpeech, as he was a great maſter of eloquence, ſoftened Luitprand to ſuch a degree, that throwing himſelf at his feet in the preſence of the whole army, he begged pardon for entering into an alliance againſt him: and, aſſuring him of his protection for the future, he went with him to the church of St Peter; and there, diſarming himſelf in the preſence of his chief officers, he laid his girdle, his ſword, and his gantlet, with his royal mantle, his crown of gold, and croſs of ſilver, on the apoſtle's ſepulchre. After this, he reconciled the pope with the exarch, who was thereupon received into the city, where he continued for ſome time, maintaining a friendly correſpondence with the pope. At this time an impoſtor, taking the name of *Tiberius*, and pretending to be deſcended from the emperors, ſeduced a great many people in Tuſcany, and was by them proclaimed emperor. The exarch reſolved to march againſt him; but as he had not ſufficient forces to oppoſe the rebels, Gregory, who let no opportunity ſlip of obliging Leo, perſuaded the Romans to attend the exarch in this expedition; by which means the uſurper being taken in a caſtle, his head was ſent to the emperor, and the rebellion utterly ſuppreſſed. But the emperor ſtill inſiſting upon his edict againſt the images being received in Rome, the Romans, at the inſtigation of the pope, publicly renounced their allegiance to Leo, paid him no more tribute, and withdrew for ever their obedience to the emperors of the Eaſt.

20
The emperor ſeizes the dominions of the pope.

Leo, informed of this revolt, and not queſtioning but the pope was the author of it, immediately cauſed all the patrimonies of the church of Rome in Sicily, Calabria, and his other dominions, to be confiſcated. At the ſame time, he ordered a powerful army to be raiſed, with a deſign to recover the towns that had revolted; to chaſtiſe the Romans for their rebellion; and, above all, to be revenged on the pope, who had raiſed all theſe diſturbances, by oppoſing himſelf, and perſuading others to oppoſe, the execution of his edict. Gregory, alarmed at the warlike preparations that were carrying on throughout the empire, and well appriſed that they were chiefly deſigned againſt him and the Romans, reſolved to recur to the protection of the French, the only nation at that time capable of coping with the emperor, and on whom, on account of their zeal for religion, he thought he might depend. The Lombards were then very powerful; but, as they wanted to be maſters of Rome, he did not think it adviſable to truſt them. The Venetians, though zealous in the defence of the pope, were not yet in a condition to withſtand the power of the emperor; and, beſides, were jealous of the Lombards, who watched all opportunities of enlarging their dominions at the expence of their neighbours. As for Spain, it was then in a moſt deplorable condition, being over-run, and almoſt wholly ruined by the Saracens.

21
Who applies to the French.

The French nation was at this time governed by the celebrated Charles Martel, who had diſtinguiſhed himſelf in a moſt eminent manner in the wars of France and Germany; and had, not long before, gained a ſignal victory over the Saracens in the neighbourhood of Tours; whence he was generally reputed the beſt commander, and the greateſt hero, of his time. To him, therefore, Gregory ſent a ſolemn embaſſy, with a great number of relics, earneſtly intreating him to take the Romans, and the church, under his protection, and defend them againſt the attempts of Leo. The ambaſſadors were received with extraordinary marks of honour; and a treaty was ſoon concluded between them and Charles, who engaged to march into Italy in perſon, at the head of a powerful army, in defence of the Romans and the church, if they ſhould be attacked either by the emperor or the Lombards. On the other hand, the Romans were to acknowledge him for their protector, and confer on him the honour of the conſulſhip, as it had been formerly conferred on Clovis by the emperor Anaſtaſius, after that prince had defeated the Viſigoths. The ambaſſadors returned from France loaded with rich preſents. But Gregory did not long enjoy the fruit of their negociations; for he died the ſame year 731, and was ſucceeded by Gregory III. in whoſe time ſome place the above-mentioned embaſſy.

22
End of the Lombard monarchy.

The French nation was at this time juſt recovered from its diſtreſſed ſituation under the deſcendants of Clovis; and by the bravery and conduct of Charles Martel, had become the moſt powerful kingdom in the weſt. His ſucceſſor Pepin was no leſs wiſe and powerful than his father had been; and as the ambition of the Lombard princes would be ſatisfied with nothing leſs than the entire conqueſt of Italy, the French monarch, Charlemagne, under colour of aſſiſting the pope, at laſt put an end to the empire of Lombardy, as related under the article FRANCE, n° 21, 22.

23
Character, &c. of the Lombards.

The Lombards were at firſt a cruel and barbarous nation; but diveſting themſelves by degrees of their native fierceneſs and barbarity, eſpecially after they had embraced the Chriſtian religion, they governed with ſuch equity and moderation, that moſt other nations envied the happineſs of thoſe who lived under them. Under the government of the Lombards (ſays Paulus Diaconus) no violence was committed, no one unjuſtly diſpoſſeſſed of his property, none oppreſſed with taxes; theft, robberies, murder, and adultery, were ſeldom heard of: every one went, without the leaſt apprehenſion, wherever he pleaſed. Their laws were ſo juſt and equitable, that they were retained in Italy, and obſerved there ſome ages after their kingdom was at an end.—According to Paulus Diaconus, alſo, their dreſs was looſe, and for the moſt part of linen, ſuch as the Anglo-Saxons wore, being interwoven with various colours; and their ſhoes were open to the end of their foot, and that they uſed to button or lace them. From ſome ancient paintings, it appears, that they ſhaved the back part of their heads, but that their hair was long before; their locks being parted, and laid on each ſide their foreheads.

LOMBARD, or LOMBART (Peter), an engraver of conſiderable eminence, who flouriſhed about the year 1660. He was a native of Paris, where he learned the art of engraving. It appears that he came into England before the revolution, becauſe ſome of his plates for Engliſh publications are dated prior to that event. He executed a vaſt variety of plates, as well hiſtorical as emblematical; which, however, were chiefly for books. But his beſt works are portraits; and of theſe he produced a conſiderable number, which are eſteemed. They are moſtly after Vandyck.—He alſo engraved hiſtorical ſubjects, from Pouſſin, Raphael, Annibal Caracci, Guido, and other maſters.

LOMENTACEÆ, in botany (from *lomentum*, a colour

colour uſed by painters), the name of the 33d order in Linnæus's Fragments of a Natural Method, conſiſting of the following genera, many of which furniſh beautiful tinctures that are uſed in dyeing, *viz.* adenanthera, bauhinia, cæſalpina, caſſia, ceratonia, cercis, gleditſia, guilandina, hæmatoxylon, hymenæa, mimoſa, parkinſonia, poinciana, polygama. See Botany, p. 464.

Loch-LOMOND, a large lake of Dunbarton or Lennox-ſhire in Scotland, of which Mr Pennant gives the following deſcription. "Loch-lomond, the laſt the moſt beautiful of the Caledonian lakes. The firſt view of it from Tarbat, preſents an extenſive ſerpentine winding amidſt lofty hills; on the north, barren, black, and rocky, which darken with their ſhade that contracted part of the water. On the weſt ſide, the mountains are cloathed near the bottoms with woods of oak quite to the water-edge; their ſummits lofty, naked, and craggy. On the eaſt ſide, the mountains are equally high; but the tops form a more even ridge parallel to the lake, except where Ben-lomond, like Saul amidſt his companions, overtops the reſt. The upper parts were black and barren; the lower had great marks of fertility, or at leaſt of induſtry, for the yellow corn was finely contraſted with the verdure of the groves intermixed with it.

"This eaſtern boundary is part of the Grampian hills, which extend from hence through the counties of Perth, Angus, Mearns, and Aberdeen. The road runs ſometimes through woods, at others is expoſed and naked; in ſome, ſo ſteep as to require the ſupport of a wall; the whole the work of the ſoldiery: bleſſed exchange of inſtruments of deſtruction for thoſe that give ſafety to the traveller, and a poliſh to the once inacceſſible native! Two great head-lands covered with trees ſeparate the firſt ſcene from one totally different; the laſt is called the *Point of Firkin*. On paſſing this cape an expanſe of water burſts at once on your eye, varied with all the ſofter beauties of nature. Immediately beneath is a flat covered with wood and corn: beyond, the headlands ſtretch, far into the water, and conſiſt of gentle riſings; many have their ſurfaces covered with wood, others adorned with trees looſely ſcattered either over a fine verdure or the purple bloom of the heath. Numbers of iſlands are diſperſed over the lake, of the ſame elevated form as the little capes and wooded in the ſame manner; others juſt peep above the ſurface, and are tufted with trees; and numbers are ſo diſpoſed as to form magnificent viſtos between.

"Oppoſite Luſs, at a ſmall diſtance from the ſhore, is a mountainous iſle almoſt covered with wood; is near half a mile long, and has a moſt fine effect. I could not count the number of iſlands, but was told there are 28; the largeſt two miles long, and ſtocked with deer.

"The length of this charming lake is 24 Scotch miles; its greateſt breadth 8; its greateſt depth, which is between the point of Firkin and Ben-lomond is 120 fathoms, Beſides the fiſh common to the lochs are guiniads, called here *poans*.

"The ſurface of Loch-lomond has for ſeveral years paſt been obſerved gradually to increaſe, and invade the adjacent ſhore: and there is reaſon to ſuppoſe that churches, houſes, and other buildings, have been loſt in the water. Near Luſs is a large heap of ſtones at a diſtance from the ſhore, known by the name of the old church; and about a mile to the ſouth of that, in the middle of a large bay, between Camſtraddan, and the iſle Inch-lavanack, is another heap, ſaid to have been the ruins of a houſe. To confirm this, it is evident by a paſſage in Cambden's Atlas Britannica, that an iſland, exiſting in his time, is now loſt; for he ſpeaks of the iſle of Camſtraddan, placed between the lands of the ſame name and Inch-lavanack, in which, adds he, was an houſe and orchard. Beſides this proof, large trees with their branches ſtill adhering are frequently found in the mud near the ſhore, overwhelmed in former times by the increaſe of water. This is ſuppoſed to be occaſioned by the vaſt quantities of ſtone and gravel that are continually brought down by the mountain rivers, and by the falls of the banks of the Leven; the firſt filling the bed of the lake, the laſt impeding its diſcharge through the bed of the river."

LOMOMOZOF, a celebrated Ruſſian poet, the great refiner of his native tongue, was the ſon of a perſon who trafficked in fiſh at Kolmogori: he was born in 1711, and was fortunately taught to read; a rare inſtance for a perſon of ſo low a ſtation in Ruſſia. His natural genius for poetry was firſt kindled by the peruſal of the Song of Solomon, done into verſe by Polotſki, whoſe rude compoſitions, perhaps ſcarcely ſuperior to our verſion of the pſalms by Sternhold and Hopkins, inſpired him with ſuch an irreſiſtible paſſion for the muſes, that he fled from his father, who was deſirous of compelling him to marry, and took refuge in the Kaikonoſpaſki monaſtery at Moſcow; there he had an opportunity of indulging his taſte for letters, and of ſtudying the Greek and Latin languages. In this ſeminary he made ſo conſiderable a progreſs in polite literature, as to be noticed and employed by the Imperial academy of ſciences. In 1736 he was ſent at the expence of that ſociety, to the univerſity of Marpurgh in Heſſe Caſſel, where he became a ſcholar of the celebrated Chriſtian Wolf, under whom he ſtudied univerſal grammar, rhetoric, and philoſophy. He continued at Marpurgh four years, during which time he applied himſelf with indefatigable diligence to chemiſtry, which he afterwards purſued with ſtill greater ſucceſs under the famous Henckel at Freyberg in Saxony. In 1741 he returned into Ruſſia; was choſen in 1742 adjunct to the imperial academy; and in the enſuing year member of that ſociety and profeſſor of chemiſtry. In 1760 he was appointed inſpector of the ſeminary, then annexed to the academy; in 1764 he was gratified by the preſent empreſs with the title of counſellor of ſtate; and died April 4th that year, in the 54th year of his age. Lomonozof excelled in various kinds of compoſition; but his chief merit, by which he bears the firſt rank among the Ruſſian writers, is derived from his poetical compoſitions, the fineſt of which are his odes. The firſt was written in 1739, while he ſtudied in Germany, upon the taking of Kotſchin, a fortreſs of Crim Tartary, by Marſhal Munich. The odes of Lomonozof are greatly admired for originality of invention, ſublimity of ſentiment, and energy of language; and compenſate for the turgid ſtyle, which, in ſome inſtances, have been imputed to them, by that ſpirit and fire which are the principal characteriſtics in this ſpecies of compoſition. Pindar was his great model; and if we may give credit to a perſon well verſed in the Ruſſian tongue, he has ſucceeded in this daring attempt to imitate the Theban bard, without incurring the cenſure of Horace. In this, as well as ſeveral other ſpecies of compoſition, he enriched his native language with various kinds of metre, and ſeems to have merited the appellation beſtowed upon him of the *Father of Ruſſian Poetry*. A brief recapitulation of the principal works of Lomonozof, which were printed in three volumes octavo, will ſerve to ſhow the verſatility of his genius, and his extenſive knowledge in various branches of literature. The firſt volume, beſide a preface on the advantages derived to the Ruſſian tongue from the eccleſiaſtical writings, contains ten ſacred and nineteen panegyric odes, and ſeveral occaſional pieces of poetry. The ſecond compriſes An Eſſay in Proſe on the Rules for Ruſſian Poetry; Tranſlation of a German Ode; Idylls; Tamira and Selim, a tragedy; Demophoon, a tragedy; Poetical Epiſtle on the Utility of Glaſs; two cantos of an epic poem, intitled, Peter the Great; A Congratulatory Copy of Verſes; An Ode; Tranſlation of Baptiſt Rouſſeau's Ode *Sur le Bonheur*; Heads of a Courſe of Lectures on Natural Philoſophy; certain paſſages tranſlated in verſe and proſe, according to the original, from Cicero, Eraſmus, Lucian, Ælian, Ammianus Marcellinus, Quintus Curtius, Homer, Virgil, Martial, Ovid, Horace, and Seneca, which Ruſſian tranſlations were brought as examples in his Lectures upon Rhetoric; laſtly, Deſcription of the Comet which appeared in 1744. The third volume conſiſts chiefly of Speeches and Treatiſes read before the Academy; Panegyric on the Empreſs Elizabeth; on Peter the Great; Treatiſe on the Advantages of Chemiſtry; on the Phenomena of the Air occaſioned by the Electrical Fire, with a Latin Tranſlation of the ſame; on the Origin of Light as a new Theory of Colours; Methods to determine with preciſion the Courſe of a Veſſel; on the Origin of Metals by the means of Earthquakes; Latin Diſſertation on Solidity and Fluidity; on the Tranſit of Venus in 1761, with a German tranſlation. Beſide theſe various ſubjects, Lomonozof made no inconſiderable figure in hiſtory, having publiſhed two ſmall works relative to that of his own country. The firſt, ſtyled Annals of the Ruſſian Sovereigns, is a ſhort chronology of the Ruſſian monarchs; and the ſecond is, the Ancient Hiſtory of Ruſſia, from the Origin of that Nation to the Death of the Great Duke Yaroſlaf I. in 1054; a performance of great merit, as it illuſtrates the moſt difficult and obſcure period in the annals of this country.

LONDON, a large city of Middleſex in England, the metropolis of Great Britain, and one of the moſt wealthy and populous places in the world, is ſituated on the river Thames, in 51° 31′ north latitude, 400 miles ſouth of Edinburgh, and 270 ſouth-eaſt of Dublin; 180 miles weſt of Amſterdam, 210 north-weſt of Paris, 500 ſouth-weſt of Copenhagen, 600 north-weſt of Vienna, 790 ſouth-weſt of Stockholm, 800 north-eaſt of Madrid, 820 north-weſt of Rome, 850 north-eaſt of Liſbon, 1360 north weſt of Conſtantinople, and 1414 ſouth-weſt of Moſcow.

1
Its different names.

The city was by the Romans firſt called *Londinium* or *Lundinum*, as we find it in Tacitus, Ptolemy, Antoninus, and Ammianus. That name was afterwards changed into *Auguſta*; in honour, as ſome ſay, of Helena Auguſta, the mother of Conſtantine the Great; while others think it more probable that it had this name from the ſecond legion, whoſe peculiar title was *Auguſta*; and ſome imagine that the honourable appellation of *Auguſta* was conferred upon this city by the Romans, as upon other principal cities of their empire, on account of its being grown up to be the capital of their Britiſh province. How long the name of *Auguſta* prevailed, is not now certainly known; but after the eſtabliſhment of the Saxons we find no more mention of Auguſta. It was then called *Caer Lundain, Lundoun Byrig, Lunden Ceaſter, Lundun-wyve, Lundane, Lunden-berh*, or *Lundenburg*; ſince the conqueſt the records call it *Londinia, Lundonia, Londine, Londres*; and, for ſeveral ages paſt, it has been called *London*, a manifeſt corruption from Tacitus's *Londinium*. The moſt probable derivation of theſe names appears to be, either from the Britiſh words *llong* "a ſhip," and *din* "a town," *i. e.* a town or harbour for ſhips; or from *Llin* "a lake," *i. e. Llin din*, "the town upon the lake;" the Surry ſide being ſuppoſed, upon very probable grounds, to have been anciently a great expanſe of water.

2
When founded.

Londinium, however, was not the primitive name of this famous place, which exiſted before the invaſion of the Romans; being, at the time of Cæſar's arrival in the iſland, the capital of the *Trinobantes* or *Trinouantes*. The name of this nation, as appears from Baxter's Britiſh Gloſſary †, was derived from the three following Britiſh words, *tri, nou, hant*, which ſignify the "inhabitants of the new city." This name, it is ſuppoſed, might have been given them by their neighbours, on account of their having newly come from the continent into Britain, and having there founded a city called *tri-now*, or the "new city;" the moſt ancient name of the renowned metropolis of Britain. The Trinobantes had come ſo lately from Belgium, that they ſeem ſcarcely to have been firmly eſtabliſhed in Britain at the time of the firſt Roman invaſion: For their new city, which ſoon after became ſo famous, was then ſo inconſiderable, that it is not mentioned by Cæſar, tho' he muſt have been within ſight of the place where it was ſituated. His ſilence about this place, indeed, is brought as a proof that he did not croſs the Thames; while Norden by the *firmiſſima civitas* of the Trinobantes underſtands the city in queſtion, the Trinobantes themſelves having been among the firſt of the Britiſh ſtates who ſubmitted to that conqueror.

† p. 230.

Henry's Hiſt. vol. 1. p. 170.

By Ptolemy, and ſome other ancient writers of good authority, indeed, Londinium is placed in Cantium, or Cent, on the ſouth ſide of the Thames; and it is the opinion of ſome moderns, that the Romans probably had a ſtation there, to ſecure their conqueſts on that ſide of the river, before they reduced the Trinobantes. The place fixed upon for this ſtation is St George's fields, a large plat of ground ſituated between Lambeth and Southwark, where many Roman coins, bricks, and checquered pavements, have been found. Three Roman ways from Kent, Surry, and Middleſex, interſected each other in this place; this therefore is ſuppoſed to be the original Londinium which it is thought became neglected after the Romans reduced the Trinobantes, and ſettled on the other ſide

ſide of the Thames ; and the name was transferred to the new city.

The ſituation of this city, as Mr Pennant obſerves, was juſt ſuch as the people would ſelect according to the rule eſtabliſhed among the Britons. An immenſe foreſt originally extended to the river-ſide, and even as late as the reign of Henry II. covered the northern neighbourhood of the city, and was filled with various ſpecies of beaſts of chace. It was defended naturally by foſſes : one formed by the creek which run along Fleet-ditch, the other afterwards known by that of Walbrook ; the ſouth ſide was guarded by the Thames; the north they might think ſufficiently protected by the adjacent foreſt.

3
When taken poſſeſſion of by the Romans.

The Romans poſſeſſed themſelves of London, on their ſecond invaſion in the reign of Claudius, about 105 years after their firſt under Cæſar. They had begun with Camalodunum, the preſent Maldon in Eſſex; and having taken it, planted there a colony conſiſting of veterans of the 14th legion. London and Verulam were next taken poſſeſſion of about one and the ſame time Camalodunum was made a *colonia*, or place governed entirely by Roman laws and cuſtoms ; Verulam (on the ſite of which St Alban's now ſtands), a *municipium*, in which the natives were honoured with the privileges of Roman citizens, and enjoyed their own laws and conſtitutions ; and Londinium only a *præfectura*, the inhabitants, a mixture of Romans and Britons, being ſuffered to enjoy no more than the name of citizens of Rome, being governed by præfects ſent annually from thence, without having either their own laws or magiſtrates. "It was even then of ſuch concourſe (ſays Mr Pennant), and ſuch vaſt trade, that the wiſe conquerors did not think fit to truſt the inhabitants with the ſame privileges as other places of which they had leſs reaſon to be jealous." But others obſerve, that this is a miſtake ; and that the Romans, in order to ſecure their conqueſt, and to gain the affections of thoſe Britons who had already ſubmitted to their authority, made London equally a municipium or free city with Verulamium, as may be ſeen by referring to Aulus Gellius, l. 16. c. 13. and to Spanhem, orbis Roman. p. 37, 38. tom. ii.

4
Ancient commerce of London.

It is difficult to ſay what were the particular articles of commerce exported from and imported into the port of London at this period. The imports and exports of the iſland in general we know ; Strabo ſays, "Britain produceth corn, cattle, gold, ſilver, iron ; beſides which, ſkins, ſlaves, and dogs naturally excellent hunters, are exported from that iſland." It is probable that the two firſt and three laſt articles were exported from London ; and perhaps, too, the gagates or jet-ſtone mentioned by Solinus as one of the productions of Britain, together with horſes, were exported from thence. The imports were at firſt ſalt, earthen ware, and works in braſs, poliſhed bits of bones emulating ivory, horſe-collars, toys of amber, glaſſes, and other articles of the ſame material.

In the reign of Nero, as Tacitus informs us, London was become a city highly famous for the great conflux of merchants, her extenſive commerce, and plenty of all things. No fewer than ſeven of the fourteen itinera of Antoninus begin or end at London ; which tends to corroborate the many proofs which might be adduced, that this city was the capital of Britain in the Roman times.

5
When firſt ſurrounded with walls.

At firſt London had no walls or other fortifications to defend it, and was therefore expoſed to the attacks of every enemy, and thus it ſuffered ſeverely about the year 64, being burnt by the Britons under Boadicea, and all the inhabitants maſſacred. But it was ſoon reſtored by the Romans and increaſed ſo much, that in the reign of the emperor Severus it is called by Herodian *a great and wealthy city*. It continued, however, in a defenceleſs ſtate for more than a century after this laſt period ; when at laſt a wall of hewn ſtone and Britiſh bricks were erected round it.

6
Their ancient courſe, &c.

London at this time extended in length from Ludgate-hill to a ſpot a little beyond the Tower. The breadth was not half equal to the length, and at each end grew conſiderably narrower. Maitland aſcribes the building of the walls to Theodoſius governor of Britain in 369. Dr. Woodward, with more probability, ſuppoſes them to have been founded under the auſpices of Conſtantine the Great ; and this ſeems to be confirmed by the numbers of coins of that emperor's mother Helena, which have been diſcovered under them, placed there by him in compliment to her. The ſame emperor made it a biſhop's ſee ; for it appears that the biſhops of London and York, and another Engliſh biſhop, were at the council of Arles in the year 314 : he alſo ſettled a mint in it, as is plain from ſome of his coins. The ancient courſe of the wall was as follows : It began with a fort near the preſent ſite of the Tower, was continued along the Minories, and the back of Houndſditch, acroſs Biſhopſgate-ſtreet, in a ſtraight line by London-wall to Cripplegate ; then returned ſouthward by Crowder's Well Alley, (where ſeveral remnants of lofty towers were lately to be ſeen) to Alderſgate ; thence along the back of Bull and Mouth-ſtreet to Newgate, and again along the back of the houſes in the Old Bailey to Ludgate ; ſoon after which it probably finiſhed with another fort, where the houſe, late the king's printing-houſe, in Black Friars, now ſtands : from hence another wall ran near the river ſide, along Thames-ſtreet, quite to the fort on the eaſtern extremity. The walls were three miles a hundred and ſixty-five feet in circumference, guarded at proper diſtances on the land ſide with fifteen lofty towers ; ſome of them were remaining within theſe few years, and poſſibly may ſtill. Maitland mentions one twenty-ſix feet high, near Gravel-lane, on the weſt ſide of Houndſditch ; another, about eighty paces ſouth-eaſt towards Aldgate ; and the baſes of another, ſupporting a modern houſe, at the lower end of the ſtreet called the Vinegaryard, ſouth of Aldgate. The walls, when perfect, are ſuppoſed to have been twenty-two feet high, the towers forty. Theſe, with the remnants of the wall, proved the Roman ſtructure, by the tiles and diſpoſition of the maſonry. London-wall, near Moorfields, is now the moſt entire part left of that ancient precinct. The gates, which received the great military roads, were four. The Prætorian way, the Saxon Watling-ſtreet, paſſed under one, on the ſite of the late Newgate ; veſtiges having been diſcovered of the road in digging above Holburn-bridge : it turned down to Dowgate, or more properly Dwr-gate or Water-gate, where there was a trajectus or ferry, to join it to the Watling-ſtreet, which was continued to Dover. The Hermin ſtreet paſſed under Cripplegate; and a vicinal way went under Aldgate by Bethnal-green, towards Oldford, a paſs over the river Lee to Duroleiton, the modern Leiton in Eſſex.

7
London ſubmits to the Saxons.

After the Romans deſerted Britain, a new and fierce race ſucceeded. The Saxons, under their leaders Hengiſt and Horſa, landed in 448, having been invited over by the provincials as auxiliaries againſt the Scots and Picts; but quarrelling with their friends, they found means to eſtabliſh themſelves in the iſland, and in proceſs of time entirely ſubdued them, as related under the article England, n° 31—44. London fell into the hands of thoſe invaders about the year 457; and became the chief city of the Saxon kingdom in Eſſex. It ſuffered much in the wars carried on between the Britons and Saxons: but it ſoon recovered; ſo that Bede calls it a *princely mart-town*, under the government of a chief magiſtrate, whoſe title of *portgrave*, or *portreve* (for we find him called by both names), conveys a grand idea of the mercantile ſtate of London in thoſe early ages, that required a governor or guardian of the port. During the civil war of the Saxons with each other, the Londoners had always the addreſs to keep themſelves neuter; and about the year 819, when all the ſeven Saxon kingdoms fell under the power of Egbert, London became the metropolis of England, which it has ever ſince continued.

8
Plundered by the Danes.

During the invaſions of the Danes, London ſuffered greatly. In 849, theſe invaders entered the Thames with 250 ſhips, plundered and burnt the city, and maſſacred the inhabitants; and two years after they returned with a fleet of 350 ſail, fully determined to deſtroy every thing that had eſcaped their barbarity in the former expedition. At this time, however, they were diſappointed; moſt of their troops being cut in pieces by king Ethelwolf and his ſon Athelbald; yet ſuch was the deſtruction made by thoſe barbarians at London, that it ſuffered more from theſe two incurſions than ever it had done before.

9
Recovers under Alfred the Great.

10
Reduced to aſhes.

11
Its government ſettled.

In the reign of king Alfred the Great, London began to recover from its former ruinous ſtate. He rebuilt its walls, drove out the Daniſh inhabitants who had ſettled there, reſtored the city to its former liberties and beauty, and committed the care of it to his ſon-in-law, Elthelred duke of Mercia, in hopes that this might always be a place of ſecure retreat within its ſtrong walls, whatever might happen from a foreign or domeſtic enemy. In 893, however, he had the mortification to ſee his capital totally reduced to aſhes by an accidental fire, which could not be extinguiſhed, as the houſes at that time were all built of wood. The walls, however, being conſtructed of incumbuſtile materials, continued to afford the ſame protection as before; the houſes were quickly rebuilt, and the city divided into wards and precincts for its better order and government. This king alſo inſtituted the office of ſheriff, the nature of which office made it neceſſary to have it alſo in London; ſo that here we have the glimmerings of the order of magiſtrates afterwards ſettled in the city of London; in the perſon of the portreve, or portgrave, or governor of the city, as ſupreme magiſtrate; in the ſheriff, and in the officer or ſubordinate magiſtate by what name ſoever then diſtinguiſhed, which, being placed at the head of each ward or precinct, were analogous to the more modern title of *aldermen* and *common-council men*.

12
Brick and ſtone houſes firſt erected.

Alfred having ſettled the affairs of England in the moſt prudent manner, directed his attention to the ornamenting, as much as poſſible, the city of London. For this purpoſe, he ſpirited up the Engliſh to an emulation in building their houſes of ſtronger and more durable materials than formerly. At that time their houſes were moſtly of wood; and an houſe built of any other materials was looked upon as a kind of wonder. But Alfred having begun to raiſe his palaces of ſtone and brick, the opulent Londoners, and the nobility reſident in and about London, followed the example, though the cuſtom did not come into general uſe till ſome ages after.

13
Beſieged by Canute.

In 1015, a foreign enemy again appeared before London. Canute king of Denmark having invaded and plundered the counties of Dorſet, Somerſet, and Wilts, ſailed up the Thames with 200 ſhips, and laid ſiege to the city. The citizens continued faithful, notwithſtanding the defection of the greateſt part of the kingdom; and made ſuch a brave reſiſtance, that Canute thought fit to withdraw his army, leaving only his fleet to blockade the city by water, that when he found a fair opportunity he might renew the ſiege with better ſucceſs. At laſt, however, being defeated in ſeveral battles by Edmund Ironſide, he was obliged to call off his ſhips to cover his own army in caſe of neceſſity. In the compromiſe, however, which was afterwards made between Edmund and Canute, the city of London was given to the latter, and owned him for its lawful ſovereign. We have a ſtrong proof of the opulence of London even at this time, from the tax laid upon it by Canute in order to pay his army; this being no leſs than 10,500l. while the reſt of the nation was at the ſame time taxed only at 72,000l.

14
Sends repreſentatives to parliament.

In 1046, we have the firſt inſtance of the Londoners ſending repreſentatives to parliament. This happened on ſettling the ſucceſſion to the throne after Canute's death. The Engliſh in general declared for Edward ſon of king Ethelred; or, if that could not be carried, for Hardicanute, ſon of Canute, by queen Emma, and then abſent on a tour to Denmark. The city of London eſpouſed the claim and intereſt of Harold Harefoot, ſon alſo of Canute, by queen Elgiva of Northampton. Edward's party ſoon declined; and the Londoners agreed, for the peace of the realm, that the two brothers ſhould divide the kingdom between them; but as Hardicanute did not return in proper time to England, a *wittenage-mote* was held at Oxford, where earl Leofric, and moſt of the thanes on the north of the Thames, with the pilots of London, choſe Harold for their king. Here, by *pilots* we are to underſtand the directors, magiſtrates, or leading men of the city: and this manifeſtly ſhows, that London was then of ſuch conſequence, that no important national affair was tranſacted without the conſent of the inhabitants; for the Saxon annals aſſure us, that none were admitted into this aſſembly of election but the nobility and the pilots of London.

15
Suffers greatly by fires, hurricanes, &c.

On the invaſion of the Normans under William I. London ſubmitted as well as the reſt of the kingdom; and received two charters from that prince, confirming

ing all the privileges they had under the Saxon kings, and adding ſeveral new ones. But while the citizens were promiſing themſelves all manner of ſecurity and tranquillity under the new government, it was almoſt entirely reduced to aſhes by an accidental fire in 1077. It had ſcarcely recovered from this calamity, when it was viſited by another of the ſame kind in 1086, which began at Ludgate, and deſtroyed the beſt and moſt opulent part of the city; conſuming, among other buildings, the cathedral of St Paul's, which, however, was ſoon rebuilt more magnificently than before. Under the reign of William Rufus, London ſuffered conſiderably by fires, hurricanes, and inundations, and ſeems to have been depreſſed by the tyranny of that prince; but Henry I. granted large immunities to the city, which again revived its trade, and was favourable to the progreſs of the arts. The king, however, ſtill retained the privilege of appointing the portreve, or chief magiſtrate; but the immunities granted to the Londoners ſecured their affections; and tended much to ſecure him on the throne. At the ſame time, there was ſuch a plenty of all kinds of proviſions, that as much corn was ſold for 1 s. as would ſuffice 100 people for a day; 4d. would purchaſe as much hay and corn as would maintain 20 horſes for a day; and a ſheep could be bought for a groat.

16 Monſtrous licentiouſneſs of the Normans. Henry thought proper alſo to check the licentious behaviour of the Normans, which, by the favour ſhowed them under the two Williams, had carried them into the moſt barbarous practices. Thoſe who followed William Rufus in his excurſions, haraſſed and plundered the country at diſcretion. Many of them were ſo extravagant in their barbarity, that what they could not eat or drink in their quarters, they either obliged the people to carry to market and ſell for their uſe, or elſe they would throw it into the fire: and, at their going off, they frequently waſhed their horſes heels with the drink, and ſtaved the caſks containing the remainder. King Henry reſolved to put a ſtop to theſe exceſſes and ſavage cuſtoms; and therefore publiſhed a proclamation at London, commanding that thenceforeward all perſons who ſhould be convicted of ſuch barbarities ſhould have their eyes pulled out, or their hands or feet cut off, as the miniſters of juſtice ſhould think fit. This effectually checked the inſolence of the Normans, and the city continued to flouriſh throughout the reigns of Henry I. and Stephen. The attachment of the citizens to Stephen, however, was a crime which never could be forgiven by Henry II. and, of conſequence, he made them ſenſible of his diſpleaſure, by making frequent demands of money from them. 17 Of the Londoners. About this time, indeed, the Londoners were arrived at ſuch a pitch of licentiouſneſs, that their proſperity ſeemed a curſe rather than a bleſſing. The ſons of the moſt eminent and wealthy citizens entered into a confederacy to commit burglaries, and to rob and murder all that came in their way in the nighttime. The king took an opportunity from theſe irregularities to enrich himſelf. He demanded ſeveral loans and free gifts; till at laſt the Londoners, to prevent further inquires into their conduct, paid into the exchequer 5000l. in three years. Theſe diſorders, however, were at laſt ſtopped by the execution of John Senex; who, though a very rich and reputable citizen, had engaged in theſe enterpriſes. He offered 500 lb. weight of ſilver, a prodigious ſum in thoſe days, for his pardon, but was refuſed. The king, however, ſtill continued to drain the citizens of their money by free gifts, and at laſt fined every ſeparate guild, fraternity, or company, that had preſumed to act as bodies corporate without the royal letters-patent.

On the death of Henry II. the title of the firſt magiſtrate of London was changed from *portgreve* to that of *bailiff*; and in 1189 claimed and acted in the office of the *chief butler* at the coronation of Richard I. In 1191 this monarch permitted the bailiff, named *Henry Fitz Alwine*, to aſſume the title of *mayor*. 18 The office of mayor when firſt inſtituted. For, in 1192, we find certain orders of the mayor and aldermen to prevent fires; whereby it was ordained, that "all houſes thereafter to be erected in London and the liberties thereof, ſhould be built of ſtone, with party-walls of the ſame; and covered either with ſlates or tiles, to prevent thoſe dreadful calamities by fire, which were frequently and chiefly occaſioned by houſes built of wood, and thatched with ſtraw or reeds." And for this purpoſe, it was alſo provided by the diſcreeter men of the city, "that 12 aldermen of the city ſhould be choſen in full huſtings, and there ſworn to aſſiſt the mayor in appeaſing contentions that might ariſe among neighbours in the city upon incloſure betwixt land and land, and to regulate the dimenſions of party-walls, which were to be of ſtone, 16 feet high and three feet thick; and to give directions about girders, windows, gutters, and wells." Such confidence alſo did Richard put in the wiſdom and faithfulneſs of the city of London, that when it was reſolved to fix a ſtandard for weights and meaſures for the whole realm, his majeſty committed the execution thereof to the ſheriffs of London and Middleſex, whom he commanded to provide meaſures, gallons, iron rods, and weights for ſtandards, to be ſent to the ſeveral counties of England. This happened in 1198, at which time corn was advanced to the enormous price of 18s. 4d. per quarter.

19 Favours granted to the city by king John. The city of London was much favoured by king John, who granted them three charters ſoon after his acceſſion. The firſt was a recital and confirmation of thoſe granted by Henry I. and II. with the farther privilege of being free from toll and every other duty or cuſtom in his majeſty's foreign dominions; for which they paid the ſum of 3000 merks. The ſecond was a confirmation of one granted by King Richard. By this the citizens of London had the juriſdiction and conſervancy of the river Thames; with a clauſe to extend that juriſdiction, and the powers therewith granted, to the river Medway; and with another clauſe to enable the ſaid city, as conſervators of the rivers Thames and Medway, to inflict a penalty of 10l. upon any perſon that ſhould preſume to erect a wear in either of theſe rivers. The third charter contains a fee-farm-rent of the ſheriffwicks of London and Middleſex at the ancient rent, of which they had been deprived by Queen Maud; granting them alſo the additional power of chooſing their own ſheriffs. This charter was given by way of conveyance from the crown to the citizens for a valuable conſideration, by which the ſheriffwick became their freehold; and this is the firſt covenant or conveyance we find on record

with the legal terms of *to have and to hold*, which are at this time accounted an eſſential part in all conveyances of property.

20 London oppreſſed by Henry III.

During the reign of Henry III. the city of London was oppreſſed in many different ways. In 1128, he exacted a fine of 50 marks for ſelling a ſort of cloth not two yards within the liſts; and a 15th of the citizens perſonal eſtates for the enjoyment of their ancient rights and privileges. In 1221, he commanded by proclamation all the foreign merchants to depart the city; which drew 30 marks from the Anſeatic company of the *Steelyard*, to have ſeiſin of their guild or hall in Thames-ſtreet. But it was the wreſtling-match at St Giles's in the fields that brought on their greateſt burden. In the year 1221, on St James's day, the citizens of London having carried off the victory from the people of Weſtminſter, and other neighbouring villages, the ſteward of the abbot of Weſtminſter, meditating revenge againſt the Londoners, propoſed another wreſtling-match with them, and gave a ram for the prize. The citizens reſorted to the place at the time appointed; but were unexpectedly aſſaulted by a great number of armed men, who killed and wounded many, and diſperſed the reſt. This raiſed a great commotion in the city. The populace breathed revenge; and, by the inſtigation of Conſtantine Fitz-Arnulph, a great favourer of the French party during the troubles in king John's reign, they proceeded to Weſtminſter, and pulled down the houſes both of the ſteward and abbot. Hearing afterwards that the abbot was come into the city with his complaint to Philip Daubney the king's counſel, they purſued him, beat his ſervants cruelly, took away 12 of his horſes, and would have murdered himſelf, had he not eſcaped by a back-door. Upon this tumult, Hubert de Bury, then chief juſticiary, ſummoned the mayor and many of the principal citizens to attend him in the tower of London; and enquiring for the authors of the riot, Conſtantine, the ringleader, boldy anſwered, that "he was one; and that they had done no more than they ought; and that they were reſolved to avow what they had done, let the conſequence be what it would." In this he was ſeconded by his nephew and one Geoffery; but the juſticiary, having diſmiſſed all the reſt, detained theſe three, and ordered them to be hanged next morning, though Conſtantine offered 15,000 marks for his pardon. Hubert then coming into the city with a ſtrong guard, cauſed the hands and feet of moſt of the principal rioters he could ſeize to be cut off: all which was executed without any legal proceedings or form of trial. After theſe arbitrary cruelties, he degraded the mayor and all the magiſtrates; placed a *cuſtos* over the city, and obliged 30 perſons of his own chooſing to become ſecurities for the good behaviour of the whole city. Several thouſand marks were alſo exacted by the king, before he would conſent to a reconciliation.

This arbitrary behaviour alarmed the whole nation. The parliament of 1224 began to be uneaſy for themſelves, and addreſſed his majeſty that he would be pleaſed to confirm the charter of liberties which he had ſworn to obſerve; and the conſequence of this application was a confirmation of the magna charta in the full parliament at Weſtminſter in the year 1225. At this time alſo, the rights and privileges of the citizens were confirmed. They were exempted from proſecutions for burels, *i.e.* a liſted cloth; and were granted the right of having a common ſeal. The neceſſitous circumſtances of this monarch, however, made him often exact money arbitrarily as long as he lived.

21 Dreadful plague in 1665.

Under the ſucceeding reigns, as the liberty of the people in general was augmented, ſo the liberty, opulence and power of the citizens of London increaſed until they became a kind of balance to the power of the crown itſelf, which in ſome meaſure they ſtill continue to be. Riots indeed, for which they generally ſuffered, were by no means unfrequent; the city often ſuffered by fires and plagues. Nothing, however, happened which materially affected the welfare of the city, till the reign of Charles II. in 1665.—This year London was ravaged by the moſt violent plague ever known in Britain. The whole ſummer had been remarkably ſtill and warm, ſo that the weather was ſometimes ſuffocating even to people in perfect health; and by this unuſual heat and ſultry atmoſphere, people were undoubtedly prepared for receiving the infection, which appeared with violence in the months of July, Auguſt, and September. A violent plague had raged in Holland in the year 1663; on which account the importation of merchandiſe from that country was prohibited by the Britiſh legiſlature in 1664. Notwithſtanding this prohibition, however, it ſeems the plague had actually been imported; for in the cloſe of the year 1664, two or three perſons died ſuddenly in Weſtminſter, with marks of the plague on their bodies. Some of their neighbours, terrified at the thoughts of their danger, removed into the city; but their removal proved too late for themſelves, and fatal to thoſe among whom they came to reſide. They ſoon died of the plague; and communicated the infection to ſo many others, that it became impoſſible to extinguiſh the ſeeds of it by ſeparating thoſe that were infected from ſuch as were not. It was confined, however, through a hard froſty winter, till the middle of February, when it again appeared in the pariſh of St Giles's to which it had been originally brought; and after another long reſt till April, ſhowed its malignant force afreſh, as ſoon as the warmth of the ſpring gave it opportunity.—At firſt, it took off one here and there, without any certain proof of their having infected each other, and houſes began to be ſhut up, with a deſign to prevent its ſpreading, but it was now too late; the infection gained ground every day, and the ſhutting up of houſes only made the diſeaſes ſpread wider. People, afraid of being ſhut up, and ſequeſtered from all communications with ſociety, concealed their illneſs, or found means to eſcape from their places of confinement; while numbers expired in the greateſt torments, deſtitute of every aſſiſtance; and many died both of the plague and other diſeaſes, who would in all probability have recovered, had they been allowed their liberty, with proper exerciſe and air.—A houſe was ſhut up on account of a maid ſervant, who had only ſpots, and not the gangrenous plague-blotches, upon her, ſo that her diſtemper was probably a petechial fever. She recovered; but the people of the houſe obtained no liberty to ſtir, either for air or exerciſe, for 40 days. The bad air, fear, anger and vexation, attending this injurious treatment, caſt the miſtreſs of the family into a fever. The viſitors appointed to ſearch

London.

ſearch the houſes, ſaid it was the plague, though the phyſicians were of a different opinion: the family, however, were obliged to begin their quarantine anew, though it had been almoſt expired before; and this ſecond confinement affected them ſo much, that moſt of the family fell ſick, ſome of one diſtemper and ſome of another. Every illneſs that appeared in the family produced a freſh prolongation of their confinement; till at laſt the plague was actually brought in by ſome of thoſe who came to inquire into the health of the family, and almoſt every perſon in the houſe died.—Many examples of a ſimilar kind happened, and this was one of the worſt conſequences of ſhutting up houſes. All means of putting a ſtop to the infection were evidently ineffectual. Multitudes fled into the country; many merchants, owners of ſhips, &c. ſhut themſelves up, on board their veſſels, being ſupplied with proviſions from Greenwich, Woolwich, and ſingle farm-houſes on the Kentiſh ſide. Here, however, they were ſafe; for the infection never reached below Deptford, though the people went frequently on ſhore to the country-towns, villages, and farm-houſes to buy freſh proviſions. As the violence of the plague increaſed, the ſhips which had families on board removed farther off; ſome went quite out to ſea, and then put into ſuch harbours and roads as they could beſt get at.

In the mean time, the diſtemper made the moſt rapid advances within the city. In the laſt week of July, the number of burials amounted to 2010; but the firſt week of Auguſt it roſe to 3817; thence to 3880: then to 4237; the next week to 6102; and at laſt to 7000 and 8000 weekly. In the laſt week of September, however, the fury of the diſeaſe began to abate; though vaſt numbers were ſick, yet the number of burials decreaſed from 7155 to 5538; the next week there was a farther decreaſe to 4929, then to 4327, next to 2665, then to 1421, and the next week to 1031.

All this while the poor people had been reduced to the greateſt diſtreſſes, by reaſon of the ſtagnation of trade, and the ſickneſſes to which they were peculiarly liable on account of their manner of living. The rich, however, contributed to their ſubſiſtence in a moſt liberal manner. The ſums collected on this occaſion, are indeed almoſt incredible; being ſaid to amount to 100,000l. per week. The king is reported to have contributed 1000l. weekly; and in the pariſh of Cripplegate alone 17,000l. was diſtributed weekly among the poor inhabitants.—By the vigilance alſo of the magiſtrates, proviſions continued remarkably cheap throughout the whole time of this dreadful calamity, ſo that all riots and tumults on that account were prevented: and at laſt, on the ceſſation of the diſeaſe in the winter of 1665, the inhabitants who had fled returned to their habitations, and London to appearance became as populous as ever, though it was computed that 100,000 perſons had been carried off by the plague.

22 Account of the great fire in 1666.

The city was ſcarcely recovered from the deſolation occaſioned by the plague, when it was almoſt totally laid in aſhes by a moſt dreadful fire. This broke out in a baker's ſhop in Pudding-lane, on Saturday night, September 2 1666. In a few hours Billingſgate ward was entirely burnt down and before morning the fire had croſſed Thames-ſtreet, and deſtroyed the church of St Magnus. From thence it proceeded to the bridge, and conſumed a great pile of buildings there; but was ſtopped by the want of any thing more to deſtroy. The flames, however, being ſcattered by a ſtrong eaſt wind, continued their devaſtations in other quarters. All efforts to ſtop it proved unſucceſsful throughout the Sunday. That day it proceeded up as far as Garlick-hithe; and deſtroying Canon-ſtreet, invaded Cornhill and the Exchange. On Monday, the flames having proceeded eaſtward againſt the wind through Thames-ſtreet, invaded Tower-ſtreet, Grace-church-ſtreet, Fenchurch-ſtreet, Dowgate, Old-fiſh-ſtreet, Watling-ſtreet, Thread-needle-ſtreet, and ſeveral others, from which it broke at once into Cheap-ſide. In a few hours Cheapſide was all in flames, the fire having reached it from ſo many places at once. The fire then continuing its courſe from the river on one ſide, and from Cheapſide on the other, ſurrounded the cathedral of St Paul's. This building ſtood by itſelf at ſome diſtance from any houſes; yet ſuch was the violence of the flames, and the heat of the atmoſphere occaſioned by them, that the cathedral took fire at top. The great beams and maſſy ſtones broke through into Faith-church underneath, which was quickly ſet on fire; after which, the flames invaded Pater-noſter-row, Newgate-ſtreet, the Old Bailey, Ludgate-hill, Fleet-ſtreet, Iron monger-lane, Old-Jury, Laurence-lane, Milk-ſtreet, Wood-ſtreet, Gutter-lane, Foſter-lane, Lothbury, Cateaton-ſtreet; and, having deſtroyed Chriſt-church, burnt furiouſly through St Martin's Le Grand towards Alderſgate.

The fire had now attained its greateſt extent, and was ſeveral miles in compaſs. The vaſt clouds of ſmoke obſcured the ſun ſo, that he either could not be ſeen at all, or appeared through it as red as blood. The flames reached an immenſe way up into the air, and their reflection from the ſmoke, which in the night-time ſeemed alſo like flame, made the appearance ſtill more terrible. The atmoſphere was illuminated to a great extent, and this illumination is ſaid to have been viſible as far as Jedburgh in Scotland. Some of the light aſhes alſo are ſaid to have been carried to the diſtance of 16 miles. Guildhall exhibited a ſingular appearance. The oak with which it was built was ſo ſolid that it would not flame, but burnt like charcoal, ſo that the building appeared for ſeveral hours like an enchanted palace of gold or burniſhed braſs.

At laſt, on Wedneſday morning, when every one expected that the ſuburbs as well as the city were to have been burnt, the fire began of itſelf to abate by reaſon of the wind having ceaſed, and ſome other changes no doubt taken place in the atmoſphere. It was checked by the great building in Leaden-hall-ſtreet, and in other ſtreets by the blowing up ſeveral houſes with gunpowder, and on Thurſday the flames were quite extinguiſhed—The following is a calculation of the damage done by this extrordinary conflagration.

23 Calculation of the damage done.

	L.	*s.*	*d.*
Thirteen thouſand two hundred houſes, at 12 years purchaſe, ſuppoſing the rent of each 25l. Sterling, - - - -	3,960,000	0	0
Eighty-ſeven pariſh-churches, at 8000l. - - - -	696,000	0	0
carried forward	4,656,000	0	0

Six

brought over L.	4,656,000	0	0
Six conſecrated chapels, 2000 l.	12,000	0	0
The royal exchange -	50,000	0	0
The cuſtom-houſe -	10,000	0	0
Fifty-two halls of companies, at 1500 l. each - -	78,000	0	0
Three city-gates at 3000 l. each	9000	0	0
Jail of Newgate - -	15,000	0	0
Four ſtone-bridges - -	6000	0	0
Seſſions-houſe - -	7000	0	0
Guildhall, with the courts and offices belonging to it - -	40,000	0	0
Blackwell-hall - -	3000	0	0
Bridewell - - - - -	5000	0	0
Poultry Compter - - - -	5000	0	0
Woodſtreet Compter - -	3000	0	0
St Paul's church - -	2,000,000	0	0
Wares, houſehold-ſtuff, money, and moveable-goods loſt or ſpoiled	2,000,000	0	0
Hire of porters, carts, waggons, barges, boats, &c. for removing goods - -	200,000	0	0
Printed books and paper, in ſhops and warehouſes - -	150,000	0	0
Wine, Tobacco, ſugar, &c. of which the town was at that time very full - -	1,500,000	0	0
	10,689,000	0	0

It was never certainly known whether this fire was accidental or deſigned. A ſuſpicion fell upon the Papiſts; and this gained ſuch general credit, that it is aſſerted for a truth on the monument which is erected in memory of the conflagration. Of the truth of this aſſertion, however, though there was not ſufficient proof, it had the effect of making the Papiſts moſt violently ſuſpected and abhored by the Proteſtants, which ſome time after proved very prejudicial to the city itſelf.

24 A deſign to ſet it on fire again.

From this calamity, great as it was, London ſoon recovered itſelf, and became much more magnificent than before; the ſtreets which were formerly crooked and narrow, being now built wide and ſpacious; and the induſtry of its inhabitants repaired the loſſes they had ſuſtained. In 1679, the city was again alarmed by the diſcovery of a deſign to deſtroy it by fire a ſecond time. Elizabeth Oxly, ſervant to one Rind in Fetter-lane, having ſet her maſter's houſe on fire, was apprehended on ſuſpicion, and confeſſed, that ſhe had been hired to do it by one Stubbs a Papiſt, for a reward of 5 l. Stubbs being taken into cuſtody, acknowledged that he had perſuaded her to it; and that he himſelf had been prevailed upon by one father Gifford his confeſſor, who had aſſured him, that by burning the houſes of heretics he would do a great ſervice to the church. He alſo owned that he had ſeveral conferences with Gifford and two Iriſhmen on the affair. The maid and Stubbs alſo agreed in declaring, that the Papiſts intended to riſe in London, expecting to be powerfully ſupported by a French army. In conſequence of this diſcovery, the Papiſts were baniſhed from the city and ten miles round, and five Jeſuits were hanged for the abovementioned plot.

25 Which gives occaſion to a quarrel with the court,

The Papiſts thought to revenge themſelves, by forging what was called the *meal-tub plot*, in which the Preſbyterians were ſuppoſed to hatch treacherous deſigns againſt the life of the king. Sir Edmonbury Godfrey alſo, who had been very active in his proceedings againſt the Papiſts, was murdered by ſome unknown perſons; and this murder, together with their diſcovering the falſehood of the meal-tub plot, ſo exaſperated the Londoners, that they reſolved to ſhow their deteſtation of Popery, by an extraordinary exhibition on the 17th of November, Queen Elizabeth's acceſſion to the throne, on which day they had uſually burnt the Pope in effigy. The proceſſion began with a perſon on horſeback perſonating Sir Edmondbury Godfrey, attended by a bell-man, proclaiming his execrable murder. He was followed by a perſon carrying a large ſilver croſs, with prieſts in copes, Carmelites, and Gray-friars, followed by ſix Jeſuits: then proceeded divers waiters, and after them ſome biſhops with lawn-ſleeves, and others with copes and mitres. Six cardinals preceded the pope, enthroned in a ſtately pageant, attended by divers boys with pots of incenſe, and the devil whiſpering in his ear. In this order they marched from Biſhopſgate to Fleetſtreet; and there, amidſt a great number of ſpectators, committed his holineſs to the flames.

This proceſſion gave great offence to the court, at which the duke of York, afterwards James II. had a great influence. This breach was farther widened by the choice of ſheriffs for that year. The candidates ſet up by the court were rejected by a majority of almoſt two to one; but this did not deter their party from demanding a poll in their behalf, upon which a tumult enſued. This was repreſented by the Popiſh party in ſuch colours to the king, that he iſſued out a commiſſion that ſame evening for trying the rioters; which, however, was ſo far from intimidating the reſt, that they grew more and more determined, not only to oppoſe the Popiſh party, but to exclude the duke of York from his ſucceſſion to the throne.

In the mean time, the king prorogued the parliament, to prevent them from proceeding in their inquiry concerning the Popiſh plot, and the excluſion-bill. Upon this the lord-mayor, aldermen, and common-council, preſented a petition to his majeſty, in which they requeſted, that he would permit the parliament to ſit in order to complete their ſalutary meaſures and councils. This petition was highly reſented by the king; who, inſtead of granting it, diſſolved the parliament, and could never afterwards be reconciled to the city. From this time it was determined to ſeize their charter; and freſh provocations having been given about the election of ſheriffs, a *quo warranto* was at laſt produced by the attorney-general, in order to overthrow their charter, and thereby to deprive the citizens of the power to chooſe ſheriffs. This information ſet forth, That "the mayor and commonalty and citizens of the city of London, by the ſpace of a month then laſt paſt and more, uſed, and yet do claim to have and uſe, without any lawful warrant or regal grant, within the city of London aforeſaid, and the liberties and privileges of the ſame city, the liberties and privileges following, viz. 1. To be of themſelves a body corporate and politic, by the name of *mayor and commonalty and citizens of the city of London*. 2. To have ſheriffs *civitat. et com. London. & com. Middleſex*, and to name, make, and elect, and conſtitute

26 A *Quo Warranto* granted againſt the city,

conſtitute them. 3. That the mayor and aldermen of the ſaid city ſhould be juſtices of the peace, and hold ſeſſions of the peace. All which liberties, privileges, and franchiſes, the ſaid mayor and commonalty, and citizens of London, upon the king did by the ſpace aforeſaid, uſurp, and yet do uſurp."

Though nothing could be more unjuſt than this proſecution, the miniſtry were determined at all events to cruſh the Londoners; rightly judging, that it would be an eaſy matter to make all other corporations ſurrender their charters into the king's hands, and that they had no other body in the nation to fear. Accordingly they diſplaced ſuch judges as would not approve of their proceedings; and, on the 12th of June 1683, Juſtice Jones pronounced the following ſentence: "That a city might forfeit its charter: that the malverſations of the common-council were acts of the whole city; and that the points ſet forth in the pleadings were juſt grounds for the forfeiting of a charter."

Notwithſtanding the ſentence, however, the attorney-general, contrary to the uſual cuſtom in ſuch caſes, was directed to move that the judgment might not be recorded; being afraid of the conſequences. Yet it was judged that the king might ſeize the liberties of the city. A common-council was immediately ſummoned to deliberate on this exigency. The country party moved to have the judgment entered; but they were over-ruled by the court-party, who inſiſted upon an abſolute ſubmiſſion to the king before judgment was entered; and though this was in effect a voluntary ſurrender of the city liberties, and depriving themſelves of the means of getting the judgment reverſed, the act of ſubmiſſion was carried by a great majority: and in a petition from the lord-mayor, aldermen, and common-council, they "acknowledged their own miſgovernment, and his majeſty's lenity; begged his pardon, and promiſed conſtant loyalty and obedience; and humbly begged his majeſty's commands and directions." To this his majeſty anſwered, that he would not reject their ſuit, if they would agree upon the following particulars. 1. That no lord-mayor, ſheriff, recorder, common-ſerjeant, town-clerk, coroner, of the city of London, or ſteward of the borough of Southwark, ſhall be capable of, or admitted to, the exerciſe of their reſpective offices before his majeſty ſhall have approved of them under his ſign manual. 2. That if his majeſty ſhall diſapprove the choice of any perſon to be lord mayor, and ſignify the ſame under his ſign manual to the lord-mayor, or, in default of a lord mayor, to the recorder or ſenior alderman, the citizens ſhall, within one week, proceed to a new choice, and if his majeſty ſhall in like manner diſapprove the ſecond choice, his majeſty may, if he pleaſes, nominate a perſon to be lord mayor for the year enſuing. 3. If his majeſty ſhall, in like manner, diſapprove the perſons choſen to be ſheriffs, or either of them, his majeſty may appoint ſheriffs for the year enſuing. 4. That the lord mayor and court of aldermen may, with the leave of his majeſty, diſplace any alderman, recorder, &c. 5. Upon the election of an alderman, if the court of aldermen ſhall judge and declare the perſon preſented to be unfit, the ward ſhall chooſe again; and upon a diſapproval of a ſecond choice, the court may appoint another in his room. 6. That the juſtices of the peace ſhould be by the king's commiſſion; and the ſettling of thoſe matters to be left to his majeſty's attorney-general, and council learned in the law."

27
Conditions of reconciliation between the king and city.

To theſe the lord keeper added, in the king's name, "That theſe regulations being made, his majeſty would not only pardon this proſecution, but would confirm their charter in ſuch a manner as ſhould be conſiſtent with them; concluding thus: "My lord mayor, the term draws towards an end, and Midſummer-day is at hand, when ſome of the officers uſed to be choſen; whereof his majeſty will reſerve the approbation. Therefore, it is his majeſty's pleaſure, that you return to the city, and conſult the common-council, that he may ſpeedily know your reſolutions thereupon, and accordingly give his directions. That you may ſee the king is in earneſt, and the matter is not capable of delay, I am commanded to let you know he hath given orders to his attorney-general to enter upon judgment on Saturday next; unleſs you prevent it by your compliance in all theſe particulars."

A common council was ſummoned, when the friends of liberty treated thoſe ſlaviſh conditions as they deſerved; and even declared, that they were ready to ſacrifice all that was near or dear them, rather than ſubmit to ſuch arbitrary impoſitions: but when it was put to the vote, there appeared a majority of 18 for ſubmiſſion.

28
The king break's his promiſe.

Thus the king got the government of the city into his own hands, though he and his brothers entirely loſt the affection of the Londoners. But, not content with their ſubmiſſion, his majeſty departed from his promiſe; commanded the judgment upon the *quo warranto* to be entered; and commiſſioned Sir William Pritchard, the lord mayor, to hold the ſame office during his majeſty's pleaſure. In the ſame manner he appointed or diſplaced the other magiſtrates as he thought proper; after which the miniſtry, having nothing to fear, proceeded in the moſt arbitrary manner.

29
Privileges of the city reſtored.

In this ſubjection to the will of the court, the city of London continued till the Revolution: but, in 1689, the immediate reſtoration of the Londoners to their franchiſes was ordered; and in ſuch a manner and form, as to put it out of the power of an arbitrary miniſtry and a corrupt judge and jury to deprive them of their chartered liberties for the time to come. Accordingly a bill was brought into parliament, and paſſed, for reverſing the judgment of the *quo warranto* againſt the city of London, and for reſtoring the ſame to its ancient rights and privileges. Since that time the city of London hath enjoyed tranquillity; its commerce hath been carried to the higheſt pitch; and for the politeneſs, riches, and number of its inhabitants, as well as its extent and the magnificence of its buildings, is inferior to no city in Europe, if not ſuperior to every one.

30
Deſcription of the city.

That part of this immenſe capital which is diſtinguiſhed by the name of *The city*, ſtands on the north ſhore of the river, from the Tower to the Temple, occupying only that ſpace formerly encompaſſed by the wall, which in circumference meaſures but three miles and 165 feet. In this wall are ſeen ſeven gates by land, viz. Ludgate, Aldgate, Cripplegate, Alderſgate, Moorgate, Biſhopſgate, which were all taken down in September, 1760; and Newgate, the county gaol, which was alſo taken down in 1776, and a maſſive building erected a little ſouth of it, which by the rioters in 1780 received damage to the amount of L. 80,000. On the ſide of the water there were Dowgate and Billingſgate, long ſince demoliſhed, as well as the poſtern-gate near the Tower. In the year 1670 there was a gate erected called Temple-Bar, which terminates the bounds of the city weſtward. The *liberties*, or thoſe parts of this great city which are ſubject to its juriſdiction and lie without the walls of London, are bounded on the eaſt, in White-chapel, the Minories, and Biſhopſgate, by bars, which were formerly poſts, and chains, that were frequently taken away by arbitrary power, when it was thought proper to ſeize the franchiſes of the city of London: on the north, they are bounded in the ſame manner in Pick-ax ſtreet, at the end of Fan-alley, and in St John's ſtreet: on the weſt, by bars in Holborn: at the eaſt end of Middle Row, and at the weſt end of Fleet-ſtreet, by the gate called *Temple-Bar*, already mentioned: on the ſouth, we may include the juriſdiction which the city holds on the river Thames, and over the borough of Southwark.

The city, including the borough, is at preſent divided into 26 wards.

31 Diviſion into wards. 1. *Alderſgate ward* takes its name from a city-gate which lately ſtood in the neighbourhood. It is bounded on the eaſt by Cripplegate ward, on the weſt, by Farringdon ward within and without; and on the ſouth, by Farringdon ward within. It is very large, and is divided into Alderſgate-within and Alderſgate-without. Each of theſe diviſions conſiſts of four precincts, under one alderman, eight common-council men, of whom two are the alderman's deputies, eight conſtables, fourteen inqueſt-men, eight ſcavengers, and a beadle; excluſive of officers belonging to the liberty of St Martin's le Grand, which contains 168 houſes.

2. *Aldgate* takes its names alſo from a gate, which was of great antiquity, being mentioned in king Edgar's charter to the knights of the Knighton Guild about the year 967; and was probably of a much more ancient foundation, for it was the gate through which the Roman Vicinal way lay to the ferry at Oldford. In the time of the wars betwixt king John and his barons, the latter entered the city through this gate, and committed great devaſtations among the houſes of the religious. Aldgate was rebuilt by the leaders of the party after the Roman manner. They made uſe ſtone which they brought from Caen, and a ſmall brick called the *Flanders tile*, which Mr Pennant thinks has been often miſtaken for Roman. The new gate was very ſtrong, and had a deep well within it. In 1471 this gate was aſſaulted by the Baſtard of Falconbridge, who got poſſeſſion of it for a few hours; but the portcullis being drawn up, the troops which had entered were all cut off, and the citizens, headed by the alderman of the ward and recorder, having made a ſally, defeated the remainder with great ſlaughter. In 1606 Aldgate was taken down and rebuilt; and many Roman coins were found in digging the foundations.—The ward of Aldgate is bounded on the eaſt by the city-wall, which divides it from Portſoken-ward; on the north, by Biſhopſgate ward; on the weſt, by Lime-ſtreet and Langbourn wards; and on the ſouth, by Tower-ſtreet ward. It is governed by an alderman, ſix common-council men, ſix conſtables, twenty inqueſt men, ſeven ſcavengers, and a beadle; beſides the officers belonging to St James's, Duke's Place.—It is divided into ſeven precincts.

3. *Baſſiſhaw* or *Baſinghall ward*, is bounded on the eaſt and ſouth by Coleman-ſtreet ward, on the north by part of Cripplegate, and on the weſt by part of the wards of Cheap and Cripplegate. On the ſouth, it begins at Blackwell-hall; and runs northward to London-wall, pulled down ſome time ago to make way for new buildings in *Fore-ſtreet*, and ſpreads 88 feet eaſt, and 54 feet weſt againſt the place where that wall ſtood. This is a very ſmall ward, and conſiſts only of two precincts; the upper precincts contains no more than 66, and the lower only 76 houſes. It is governed by an alderman, four common council men, of whom one is the alderman's deputy, three conſtables, ſeventeen inqueſt-men, three ſcavengers, and a beadle. It has its name from Baſinghall, the manſion-houſe of the family of *Baſings*, which was the principal houſe in it, and ſtood in the place of Blackwell hall.

4. *Billingſgate ward* is bounded on the eaſt by Tower-ſtreet ward, on the north, by Langbourn ward; on the weſt, by the ward of Bridge-within; and on the ſouth, by the river Thames. There have been many conjectures concerning the origin of the name of *Billingſgate*, none of which ſeems to be very well authenticated. It is, for inſtance, ſuppoſed to have derived its name from a Britiſh king named *Belinus*, ſaid to have been an aſſiſtant of Brennus king of the Gauls at the taking of Rome, and is the ſame with the *Beli-Maur* mentioned in the Welſh genealogies, The name of *Ludgate* is ſaid to be derived from his ſon *Lud*.—It is divided into 12 precincts; and is governed by an alderman, 10 common-council men, one of whom is the alderman's deputy, 11 conſtables, 14 inqueſt-men, ſix ſcavengers, and a beadle. The ſituation of Billingſgate, on the river, gives it great advantages with reſpect to trade and merchandize; ſo that it is well inhabited, and is in a continual hurry of buſineſs at the ſeveral wharves or quays.

5. *Biſhopſgate ward* is bounded on the eaſt by Aldgate ward, Portſoken-ward, and part of the Tower-liberty, or Norton-falgate; on the weſt, by Broadſtreet ward and Moorfields; and on the ſouth, by Langbourn ward. It is very large, and divided into Biſhopſgate-within and Biſhopſgate-without. The firſt contains all that part of the ward within the city-wall and gate, and is divided into five precincts; the ſecond lies without the wall, and is divided into four precincts. Biſhopſgate-without extends to Shoreditch, taking its name from one Sir John de Sordich, an eminent lawyer much in favour with king Edward III. both on account of his knowledge in the law, and of his perſonal valour. In the time of Henry VIII. one Barlo, a citizen and inhabitant of this place, was named *duke of Shoreditch*, on account of his ſkill in archery; and, for a number of years after, the title belonged to the captain of the London archers. This ward is governed by an alderman, two deputies, one within and the other without, 12 common-council men, ſeven conſtables, 13 inqueſt-men, nine ſcavengers, and two beadles. It took its name from the gate, which has been pulled down to make that part of the city more airy and commodious. This gate was built by

Erkenwald biſhop of London in 675; and it is ſaid to have been repaired by William the Conqueror ſoon after the Norman conqueſt. In the time of Henry III. the Hanſe merchants had certain privileges confirmed to them, in return for which they were to ſupport this gate; and in conſequence of this they rebuilt it elegantly in 1479. There were two ſtatues of biſhops, in memory of the founder and firſt repairer; other two were alſo put up, which are ſuppoſed to have been deſigned for Alfred and Ældred earl of Mercia, to whoſe care the gate had been committed.

6. *Bread-ſtreet ward* is encompaſſed, on the north and north-weſt, by the ward of Fardingdon-within; on the eaſt, by Cordwainer's ward; on the ſouth by Queenhithe-ward; and on the weſt, by Caſtle-Baynard ward. It is divided into 13 precincts; and is governed by an alderman, 12 common council-men, of whom one is the alderman's deputy, 13 conſtables, 13 inqueſt-men, 13 ſcavengers, and a beadle; and yet contains no more than 331 houſes. It takes its name from the ancient bread-market, which was kept in the place now called *Bread-ſtreet;* the bakers being obliged to ſell their bread only in the open market and not in ſhops.

7. *Bridge-ward within* is bounded on the ſouth by the river Thames and Southwark; on the north, by Langbourn and Biſhopſgate ward; on the eaſt, by Billingſgate; and on the weſt, by Candlewick and Dowgate wards. It is divided into 14 precincts, three of which were on London-bridge; and is governed by an alderman, 15 common-council men, one of whom is the alderman's deputy, 14 conſtables, 15 inqueſt-men, 14 ſcavengers, and a beadle. It takes its name from its connection with London-bridge.

8. *Broad-ſtreet ward* is bounded, on the north and eaſt, by Biſhopſgate ward; on the ſouth, by Cornhill and Wallbrook ward; and on the weſt by Coleman-ſtreet ward. It is divided in 10 precincts; and governed by an alderman, 10 common-council men, one of whom is the alderman's deputy, 10 conſtables, 13 inqueſt-men, eight ſcavengers, and a beadle. It has its name from that part of it now diſtinguiſhed by the name of *Old Broad ſtreet;* and which, before the fire of 1666, was accounted one of the broadeſt ſtreets in London.

9. *Candlewick ward, Candlewick-ſtreet,* or *Candlewright ſtreet ward,* as it is called in ſome ancient records, is bounded on the eaſt by Bridge ward; on the ſouth, by Dowgate and part of Bridge ward; on the weſt, by Dowgate and Wallbrook; and on the north, by Langbourn ward. It is but a ſmall ward, conſiſting of about 286 houſes; yet is divided into ſeven precincts. It is governed by an alderman, eight common-council men, of whom one is the alderman's deputy, ſeven conſtables, 13 inqueſt-men, ſeven ſcavengers, and a beadle. It has its name from a ſtreet, formerly inhabited chiefly by candle wrights or candlemakers, both in tallow and wax: a very profitable buſineſs in the times of Popery, when incredible quantities of wax-candles were conſumed in the churches. That ſtreet, however, or at leaſt its name, *Candlewick,* is loſt ſince the great conflagration, for which the name *Canon-ſtreet* is ſubſtituted, the candle wrights being at that time burnt out and diſperſed through the city.

10. *Caſtle-Baynard ward* is bounded by Queenhithe and Bread-ſtreet wards on the eaſt; on the ſouth, by the Thames; and on the weſt and north, by the ward of Farringdon-within. It is divided into 10 precincts, under the government of an alderman, 10 common council-men, one of whom is the alderman's deputy, nine conſtables, 14 inqueſt-men, ſeven ſcavengers, and a beadle. It takes its name from a caſtle built on the bank of a river by one Baynard, a ſoldier of fortune, who came in with William the Conqueror, and was by that monarch raiſed to great honours and authority.

11. *Cheap ward* is bounded on the eaſt by Broadſtreet and Wallbrook wards; on the north, by Coleman-ſtreet, Baſſiſhaw, and Cripplegate; and on the ſouth, by Cordwainer's ward. It is divided into nine precincts; and is governed by an alderman, 12 common-council men, of whom one is the alderman's deputy, 11 conſtables, 13 inqueſt-men, nine ſcavengers, and a beadle. It has its name from the Saxon word *chepe,* which ſignifies a market, kept in this diviſion of the city, now called *Cheapſide;* but then known by the name of *Weſtcheap,* to diſtinguiſh it from the market then alſo kept in Eaſtcheap, between Canon or Candlewick ſtreet and Tower-ſtreet.

12. *Coleman-ſtreet-ward* is bounded on the eaſt by Biſhopſgate, Broadſtreet, and Cheap wards; on the north, by Cripple-gate ward, Middle Moorfields, and Biſhopſgate; on the ſouth, by Cheap ward; and on the weſt, by Baſſiſhaw ward. It is divided into ſix precincts; and is governed by an alderman, ſix common-council men, one of whom is the alderman's deputy, ſix conſtables, 13 inqueſt men, ſix ſcavangers, and a beadle. The origin of the name is not certainly known.

13. *Cordwainers ward* is bounded on the eaſt by Wall-brook, on the ſouth by Vintry-ward, on the weſt by Bread-ſtreet, and on the north by Cheap-ward. It is divided into eight precincts; and is governed by an alderman, eight common-council men, one of whom is the alderman's deputy, eight conſtables, 14 inqueſt men, eight ſcavengers, and a beadle. Its proper name is *Cordwainers-ſtreet ward;* which it has from Cordwainers ſtreet, now Bow-lane, formerly occupied chiefly by ſhoemakers and others that dealt or worked in leather.

14. *Cornhill ward* is but of ſmall extent. It is bounded on the eaſt by Biſhopſgate, on the north by Broad ſtreet, on the weſt by Cheap ward, and on the ſouth by Langbourn ward. It is divided into four precincts, which are governed by one alderman, ſix common-council men, of whom one is the alderman's deputy, four conſtables, 16 inqueſt-men, four ſcavengers, and a beadle. It takes its name from the principal ſtreet in it, known from the earlieſt ages by the name of *Cornhill,* becauſe the corn-market was kept there.

15. *Cripplegate ward* is bounded on the eaſt by Moorfields, Coleman-ſtreet ward, Baſſiſhaw ward, and Cheap ward; on the north by the pariſh of St Luke's, Old ſtreet; on the weſt, by Alderſgate ward; and on the ſouth, by Cheap-ward. It is divided into 13 precincts, nine within and four without the wall; and is governed by an alderman, 12 common council men, of whom two are the alderman's deputies, 13 conſtables, 34 inqueſt-men, 16 ſcavengers, and three beadles. It

takes its name from Cripplegate, which ſtood on the north-weſt part of the city-wall. It was an old plain ſtructure, void of all ornament, with one poſtern; but had more the appearance of a fortification than any of the other gates. It was removed in order to widen the entrance into Wood-ſtreet, which, by the narrowneſs of the gateway was too much contracted and rendered dangerous for paſſengers and great waggons.

16. *Dowgate ward* is bounded on the eaſt by Candlewick and Bridge wards, on the north by Wallbrook ward, on the weſt by Vintry ward, and on the ſouth by the Thames. It is divided into eight precincts, under the government of an alderman, eight common-council men of whom one is the alderman's deputy, eight conſtables, 15 inqueſt-men, five ſcavengers, and a beadle. It has its name from the ancient water-gate, called *Dourgate*, which was made in the original wall that ran along the north ſide of the Thames, for the ſecurity of the city againſt all attempts to invade it by water.

17. *Farringdon ward within* is bounded on the eaſt by Cheap ward and Baynard-caſtle ward; on the north, by Alderſgate and Cripplegate wards, and the liberty of St Martin's le Grand; on the weſt, by Farringdon-without; and on the ſouth, by Baynard-caſtle ward, and the river Thames. It is divided into 18 precincts; and governed by one alderman, 17 common-council men, of whom one is the alderman's deputy, 19 conſtables, 17 inqueſt-men, 19 ſcavengers, and two beadles. It takes its name from William Farringdon citizen and goldſmith of London, who, in 1279, purchaſed all the aldermanry with the appurtenances, within the city of London and ſuburbs of the ſame, between Ludgate and Newgate, and alſo *without* theſe gates.

18. *Farringdon-ward without* is bounded on the eaſt by *Farringdon within*, the precinct of the late priory of St Bartholomew near Smithfield, and the ward of Alderſgate; on the north, by the charter-houſe, the pariſh of St John's Clerkenwell, and part of St Andrew's pariſh without the freedom; on the weſt, by High Holborn and St Clement's pariſh in the Strand; and on the South by the river Thames. It is governed by one alderman, 16 common-council men, of whom two are the alderman's deputies, 23 conſtables, 48 inqueſt-men; 24 ſcavengers; and four beadles. It takes its name from the ſame goldſmith who gave name to Farringdon-within.

19. *Langhorn ward* is bounded on the eaſt by Aldgate ward; on the north, by part of the ſame, and Limeſtreet ward; on the ſouth, by Tower-ſtreet, Billingſgate, Bridge, and Candlewick wards; and on the weſt by Wallbrook. It is divided into 12 precincts. It had its name from a rivulet or long bourn of freſh-water, which anciently flowed from a ſpring near Magpye alley adjoining to St Catherine Coleman's church.

20. *Limeſtreet ward* is bounded on the eaſt and north by *Aldgate ward*, on the weſt by Biſhopſgate; and on the ſouth by Langbourn ward. It is divided into four precincts; and governed by an alderman, four common-council men, one of whom is the alderman's deputy, four conſtables, 13 inqueſt-men, four ſcavengers, and a beadle. It is very ſmall; and has its name from ſome lime-kilns that were formerly built in or near Lime-ſtreet.

21. *Portſoken ward* is bounded on the eaſt by the pariſhes of Spitalfields, Stepney, and St George's in the eaſt; on the ſouth, by Tower-hill; on the north, by Biſhopſgate ward, and on the weſt by Aldgate ward. It is divided into five precincts; and is governed by an alderman, five common-council men, one of whom is the alderman's deputy, five conſtables, 19 inqueſt-men, five ſcavengers, and a beadle. Its name ſignifies the *franchiſe of the liberty gate*. This Portſoken was for ſome time a guild; and had its beginning in king Edgar, when 13 knights, "well beloved of the king and realm, for ſervices by them done," requeſted to have a certain portion of land on the eaſt part of the city, left deſolate and forſaken of the inhabitants by reaſon of too much ſervitude. They beſought the king to have this land, with the liberty of a guild for ever. The king granted their requeſt on the following conditions, *viz.* that each of them ſhould victoriouſly accompliſh three combats, one above the ground, one under ground, and the third in the water: and after this, at a certain day, in Eaſt Smithfield, they ſhould run with ſpears againſt all comers. All this was gloriouſly performed; upon which the king named it *Knighten Guild*, and extended it from Aldgate to the places where the bars now are on the eaſt, and to the Thames on the ſouth, and as far into the water as an horſeman could ride at low water and throw his ſpear.

22. *Queen-hithe ward* is bounded on the eaſt by Dowgate, on the north by Bread-ſtreet and Cordwainers wards, on the ſouth by the Thames, and on the weſt by Caſtle-Baynard ward. It is divided into nine precincts; and is governed by one alderman, ſix common-council men, one of whom is the alderman's deputy, and nine conſtables. It has its name from the *hithe*, or harbour for large boats, barges, and lighters; for which, and even for ſhips, it was the anchoring place, and the key for lading and unloading veſſels almoſt of any burden uſed in ancient times. It has the name of *queen*, becauſe the queens of England uſually poſſeſſed the tolls and cuſtoms of veſſels that unloaded goods at this hithe, which were very conſiderable.

23. *Tower ward*, or *Tower-ſtreet ward*, is bounded on the ſouth by the river Thames, on the eaſt by Tower-hill and Aldgate ward, on the north by Langbourn ward, and on the weſt by Billingſgate ward. It is governed by one alderman, 12 common-council men, of whom one is the alderman's, deputy, 12 conſtables, 13 inqueſt men, 12 ſcavengers, and one beadle. It takes it name from *Tower ſtreet*, ſo called becauſe it leads out of the city in a direct line to the principal entrance of the Tower of London.

24. *Vintry ward* is bounded on the eaſt by Dowgate, on the ſouth by the Thames, on the weſt by Queen-hithe ward, and on the north by Cordwainers ward. It is a ſmall ward, containing only 418 houſes; but is divided into nine precincts, and governed by an alderman, nine common-council men, one of whom is the alderman's deputy, nine conſtables, 13 inqueſt-men, three ſcavengers, and a beadle. It takes its name from the vintners or wine-merchants of Bourdeaux, who formerly dwelt in this part of the city, and were obliged to land their wines on this ſpot, and to ſell them in 40 days, till the 28th of Edward I.

25. *Wall-brook ward* is bounded on the eaſt by Langbourn, on the ſouth by Dowgate ward, on the weſt by Cordwainers ward, and on the north by Cheap ward. It is ſmall, containing only 306 houſes; but is divided into ſeven precincts, and governed by an alderman, eight common-council men, of whom one is the alderman's deputy, ſeven conſtables, 13 inqueſt-men, ſix ſcavengers, and a beadle. It has its name from the rivulet *Wall-brook*, that ran down the ſtreet of this name into the river Thames near Dowgate; but in proceſs of time it was ſo loſt by covering it with bridges and buildings upon thoſe bridges, that its channel became a common ſewer.

26. The ward of *Bridge-without*, includes the borough of Southwark, and the pariſhes of Rotherhithe, Newington, and Lambeth. It has its name from London-bridge, with the addition of the word *without*, becauſe the bridge muſt be paſſed in order to come at it. *Weſtminſter* is generally reckoned a part of London, though under a diſtinct government; and has long been famous for the palace of the Britiſh kings, the ſeat of their law tribunals, and the high court of parliament; all which ſhall be deſcribed in their order.

32 Government of London. The city and liberties of London are under an eccleſiaſtical, a civil, and a military government.

33 Eccleſiaſtical. As to its *eccleſiaſtical* government, London is a biſhop's ſee, the dioceſe of which comprehends not only Middleſex, Eſſex, and part of Hertfordſhire, but the Britiſh plantations in America. The biſhop of London takes precedency next to the archbiſhops of Canterbury and York; but the following pariſhes of this city are exempt from his juriſdiction, being peculiars under the immediate government of the archbiſhop of Canterbury, *viz.* All-hallows in Bread-ſtreet, All-hallows Lombard-ſtreet; St Dionys Back-church, S Dunſtan in the Eaſt, St John Baptiſt, St Leonard Eaſtcheap, St Mary Aldermary, St Mary Bothaw, St Mary le Bow, St Michael Crooked-lane, St Michael Royal, St Pancras Soper-lane, and St Vedaſt Foſter-lane.

34 Civil. The *civil* government of London divides it into wards and precincts, under a lord-mayor, aldermen, and common-council.

35 Lord-mayor. The mayor, or lord-mayor, is the ſupreme magiſtrate, choſen annually by the citizens, purſuant to a charter of King John. The preſent manner of electing a lord-mayor is by the liverymen of the ſeveral companies aſſembled in Guildhall annually on Michaelmas-day, according to an act of common-council in A. D. 1476, where, and when, the liverymen chooſe, or rather nominate, two aldermen below the chair, who have ſerved the office of ſheriff, to be returned to the court of Aldermen, who may chooſe either of the two; but generally declare the ſenior of the two, ſo returned, to the lord-mayor elect. The election being over, the lord-mayor elect, accompanied by the recorder and divers aldermen, is ſoon after preſented to the lord-chancellor (as his majeſty's repreſentative in the city of London) for his approbation; and on the 9th of November following is ſworn into the office of mayor at Guildhall; and on the day after, before the barons of the exchequer at Weſtminſter; the proceſſion on which occaſion is exceedingly grand and magnificent.

The lord-mayor ſits every morning at the manſion-houſe, or place where he keeps his mayoralty, to determine any difference that may happen among the citizens, and to do other buſineſs incident to the office of a chief magiſtrate. Once in ſix weeks, or eight times in the year, he ſits as chief judge of Oyer and Terminer, or gaol-delivery of Newgate for London, and the county of Middleſex. His juriſdiction extends all over the city and ſuburbs, except ſome places that are exempt. It extends alſo from Colneyditch, above Staines-bridge in the weſt, to Yeudale, or Yenflete, and the mouth of the river Medway, and up that river to Upnor-caſtle, in the eaſt: by which he exerciſes the power of puniſhing and correcting all perſons that ſhall annoy the ſtreams, banks, or fiſh. For which purpoſe his lordſhip holds ſeveral *courts of conſervancy* in the counties adjacent to the ſaid river, for its conſervation, and for the puniſhment of offender's. See the article MAYOR'*s Court*.

Aldermen. The title of dignity, *alderman*, is of Saxon original, and of the greateſt honour, anſwering to that of earl; though now it is no where to be found but in chartered ſocieties. And from hence we may acount for the reaſon why the aldermen and commonalty of London were called *barons* after the conqueſt. Theſe magiſtrates are properly the ſubordinate governors of their reſpective wards under the lord-mayor's juriſdiction: and they originally held their aldermanries either by inheritance or purchaſe; at which time the aldermanries or wards changed their names as often as their governors or aldermen. The oppreſſions, to which the citizens were ſubject from ſuch a government, put them upon the means to aboliſh the perpetuity of that office; and they brought it to an annual election. But that manner of election being attended with many inconveniences, and becoming a continual bone of contention amongſt the citizens, the parliament, 17 Richard II. A. D. 1394, enacted, That the aldermen of London ſhould continue in their ſeveral offices during life or good behaviour. And ſo it ſtill continues: though the manner of electing has ſeveral times varied. At preſent it is regulated by an act of parliament, paſſed in the year 1724-5: and the perſon ſo elected is to be returned by the lord-mayor (or other returning officer in his ſtead, duly qualified to hold a court of wardmote) to the court of lord-mayor and aldermen, by whom the perſon ſo returned muſt be admitted and ſworn into the office of alderman before he can act. If the perſon choſen refuſeth to ſerve the office of alderman, he is finable 500l.

Theſe high officers conſtitute a ſecond part of the city legiſlature when aſſembled in a corporate capacity, and exerciſe an executive power in their reſpective wards. The aldermen who have paſſed the chair, or ſerved the high office of lord-mayor, are juſtices of the quorum: and all the other aldermen are not only juſtices of the peace, but by the ſtatute of 43 Eliz. intitled, *An act for the relief of the poor*, every alderman of the city of London within his ward, ſhall and may do and execute, in every reſpect ſo much as is appointed and allowed by the ſaid act to be done or executed by one or *two* juſtices of peace of any county within this realm." They every one keep their *wardmote*, or *court*, for chooſing ward-officers and ſettling the affairs of the ward, to redreſs grievances, and to preſent all defaults found within their reſpective wards.

The next branch of the legiſlative power in this

36 Common-council. city is the *common-council*. The many inconveniences that attended popular aſſemblies, which were called *folkmote*, determined the commonalty of London to chooſe repreſentatives to act in their name and for their intereſt, with the lord-mayor and aldermen, in all affairs relating to the city. At firſt theſe repreſentatives were choſen out of the ſeveral companies: but that not being found ſatisfactory, nor properly the repreſentatives of the whole body of the inhabitants, it was agreed to chooſe a certain number of diſcreet men out of each ward: which number has from time to time increaſed according to the dimenſions of each ward: and at preſent the 25 wards, into which London is divided, being ſubdivided into 236 precincts, each precinct ſends a repreſentative to the common-council, who are elected after the ſame manner as an alderman, only with this difference, that as the lord-mayor preſides in the wardmote, and is judge of the poll at the election of an alderman, ſo the alderman of each ward is judge of the poll at the election of a common-council man.

Thus the lord-mayor, aldermen, and common-council, when aſſembled, may be deemed the city parliament, reſembling the great council of the nation. For it conſiſts of two houſes; one for the lord-mayor and aldermen, or the upper houſe; another for the commoners or repreſentatives of the people, commonly called the *common-council-men*. And they have power in their incorporate capacity to make and repeal bye-laws; and the citizens are bound to obey or ſubmit to thoſe laws. When they meet in their incorporate capacity, they wear deep blue ſilk gowns: and their aſſemblies are called the *court of common-council*, and their ordinances *acts of common-council*. No act can be performed in the name of the city of London without their concurrence. But they cannot aſſemble without a ſummons from the lord-mayor; who, nevertheleſs, is obliged to call a common-council, whenever it ſhall be demanded, upon extraordinary occaſions, by ſix reputable citizens and members of that court.

37 Sheriffs. This corporation is aſſiſted by two ſheriffs and a recorder. The ſheriffs are chartered officers, to perform certain ſuits and ſervices, in the king's name, within the city of London and county of Middleſex, choſen by the liverymen of the ſeveral companies on Midſummer day. Their office, according to Cambden, in general, is to collect the public revenues within their ſeveral juriſdictions; to gather into the exchequer all fines belonging to the crown; to ſerve the king's writs of proceſs; to attend the judges, and execute their orders; to impannel juries; to compel headſtrong and obſtinate men by the *poſſe comitatus*, to ſubmit to the deciſions of the law; and to take care that all condemned criminals be duly puniſhed and executed. In particular, in London, they are to execute the orders of the common-council, when they have reſolved to addreſs his majeſty, or to petition parliament.

The ſheriffs, by virtue of their office, hold a court at Guildhall every Wedneſday and Friday, for actions entered at Wood-ſtreet Compter; and on Thurſdays, and Saturdays for thoſe entered at the Poultry Compter: of which the ſheriffs being judges, each has his aſſiſtant, or deputy, who are called the judges of thoſe courts; before whom are tried actions of debt, treſpaſs, covenant, &c. and where the teſtimony of any abſent witneſs in writing is allowed to be good evidence. To each of theſe courts belong four attornies, who, upon their being admitted by the court of aldermen, have an oath adminiſtered to them.

To each of theſe courts likewiſe belong a ſecondary, a clerk of the papers, a prothonotary, and four clerks-ſitters. The ſecondary's office is to allow and return all writs brought to remove clerks out of the ſaid courts; the clerk of the papers files and copies all declarations upon actions; the prothonotary draws and ingroſſes all declarations; the clerk-ſitters enter actions and attachments, and take bail and verdicts. To each of the compters, or priſons belonging to theſe courts, appertain 16 ſerjeants at mace, with a yeoman to each, beſides inferior officers, and the priſon-keeper.

In the ſheriffs court may be tried actions of debt, caſe, treſpaſs, account, covenant, and all perſonal actions, attachments, and ſequeſtrations. When an erroneous judgment is given in either of the ſheriffs courts of the city, the writ of error to reverſe this judgment muſt be brought in the court of huſtings before the lord-mayor; for that is the ſuperior court. The ſheriffs of London may make arreſts and ſerve executions on the river Thames.

38 Recorder. We do not read of a recorder till 1304, who, by the nature of his office, ſeems to have been intended as an aſſiſtant to, or aſſeſſor with, the lord-mayor, in the execution of his high office, in matters of juſtice and law. He is choſen by the lord-mayor and aldermen only; and takes place in all courts, and in the common-council, before any one that hath not been mayor. Of whom we have the following deſcription in one of the books of the chamber. "He ſhall be, and is wont to be, one of the moſt ſkilful and virtuous apprentices of the law of the whole kingdom; whoſe office is always to ſit on the right hand of the mayor, in recording pleas, and paſſing judgments; and by whom records and proceſſes, had before the lord-mayor and aldermen at Great St Martin's, ought to be recorded by word of mouth before the judges aſſigned there to correct errors. The mayor and aldermen have therefore uſed commonly to ſet forth all other buſineſſes, touching the city, before the king and his council, as alſo in certain of the king's courts, by Mr Recorder, as a chief man, endued with wiſdom, and eminent for eloquence."—Mr Recorder is looked upon to be the mouth of the city, to deliver all addreſſes to the king, &c. from the corporation; and he is the firſt officer in order of precedence that is paid a ſalary, which originally was no more than 10l. Sterling *per annum*, with ſome few perquiſites; but it has from time to time been augmented to 1000l. *per annum*, and become the road to preferment in the law. This office has ſometimes been executed by a deputy.

39 Chamberlain. The next chartered officer of this corporation is the chamberlain; an office of great repute and truſt, and is in the choice of the livery annually. This officer, though choſen annually on Midſummer-day, is never diſplaced during his life, except ſome very great crime can be made out againſt him. He has the keeping of the moneys, lands, and goods, of the city-orphans, or takes good ſecurity for the payment thereof when the parties come to age. And to that end he is deemed in the law a ſole corporation, to him and his ſucceſ-

ſors,

ſors, for orphans; and therefore a bond or a recognizance made to him and his ſucceſſors, is recoverable by his ſucceſſors. This officer hath a court peculiarly belonging to him. His office may be termed a public treaſury, collecting the cuſtoms, moneys, and yearly revenues, and all other payments belonging to the corporation of the city. It was cuſtomary for government to appoint the chamberlain receiver of the land tax; but this has been diſcontinued for ſeveral years paſt.

40 Other officers.

The other officers under the lord-mayor are, 1, The common ſerjeant. He is to attend the lord-mayor and court of aldermen on court days, and to be in council with them on all occaſions, within or without the precincts or liberties of the city. He is to take care of orphans eſtates, either by taking account of them, or to ſign their indentures, before their paſſing the lord-mayor and court of aldermen. And likewiſe he is to let, ſet, and manage the orphans eſtates, according to his judgment, to the beſt advantage. 2. The town-clerk; who keeps the original charter of the city, the books, rolls, and other records, wherein are regiſtered the acts and proceedings of the city; ſo that he may not be improperly termed the city-regiſter; he is to attend the lord-mayor and aldermen at their courts, and ſigns all public inſtruments. 3. The city remembrancer; who is to attend the lord-mayor on certain days, his buſineſs being to put his lordſhip in mind of the ſelect days, he is to go abroad with the aldermen, &c. He is to attend daily at the parliament-houſe, during the ſeſſions, and to report to the lord-mayor their tranſactions. 4. The ſword-bearer: who is to attend the lord-mayor at his going abroad, and to carry the ſword before him, being the emblem of juſtice. This is an ancient and honourable office, repreſenting the ſtate and princely office of the king's moſt excellent majeſty in his repreſentative the lord-mayor; and, according to the rule of armoury, "He muſt carry the ſword upright, the hilts being holden under his bulk, and the blade directly up the midſt of his breaſt, and ſo forth between the ſword-bearer's brows." 5. The common hunt; whoſe buſineſs it is to take care of the pack of hounds belonging to the lord mayor and citizens, and to attend them in hunting in thoſe grounds to which they are authoriſed by charter. 6. The common-crier It belongs to him and the ſerjeant at arms, to ſummon all executors and adminiſtrators of freemen to appear, and to bring in inventories of the perſonal eſtates of freemen, within two months after their deceaſe; and he is to have notice of the appraiſements. He is alſo to attend the lord-mayor on ſet days, and at the courts held weekly by the mayor and aldermen. 7. The water-bailiff; whoſe office is to look after the preſervation of the river Thames againſt all encroachments; and to look after the fiſhermen for the preſervation of the young fry, to prevent the deſtroying them by unlawful nets. For that end, there are juries for each county, that hath any part of it lying on the ſides or ſhores of the ſaid river; which juries ſummoned by the water-bailiff at certain times, do make inquiry of all offences relating to the river and the fiſh, and make their preſentments accordingly. He is alſo bound to attend the lord-mayor on ſet days in the week.—Theſe ſeven purchaſe their places; except the town-clerk who is choſen by the livery.

There are alſo three ſerjeant-carvers; three ſerjeants of the chamber; a ſerjeant of the channel; four yeomen of the water-ſide; an under water-bailiff; two yeomen of the chamber; two meal-weighers; two yeomen of the wood wharfs; a foreign taker; city-marſhals. There are beſides theſe, ſeven gentlemens men; as, the ſword-bearer's man, the common-hunt's two men, the common crier's man, and the carver's three men.

Nine of the foregoing officers have liveries of the lord-mayor, *viz* the ſword-bearer and his man, the three carvers, and the four yeomen of the water-ſide. All the reſt have liveries from the chamber of London.

The following officers are likewiſe belonging to the city; farmer of the markets, auditor, clerk of the chamber, clerk to the commiſſioners of the ſewers, clerk to the court of conſcience, beadle of the ſame court, clerk of the city-works, printer to the city, juſtice of the Bridge-yard, clerk-comptroller of the Bridge-houſe, ſteward of the Borough, bailiff of the Borough.

There is alſo a coroner, called ſo from *corona*, i. e. a *crown*, becauſe he deals principally with the crown, or in matters appertaining to the imperial crown of England. See the article CORONER.

Beſides theſe officers, there are ſeveral courts in this city for the executing of juſtice, *viz.* the court of huſtings, lord-mayor's court, &c. In the city there are alſo two ſubordinate kinds of goverment. One executed by the alderman, deputy, and common-council men, and their inferior officers, in each ward: under which form are comprehended all the inhabitants free or not free of the city. Every ward is therefore like a little free ſtate, and at the ſame time ſubject to the lord-mayor as chief magiſtrate of the city. The houſe keepers of each ward elect their repreſentatives the common-council, who join in making bye-laws for the government of the city. The officers and ſervants of each ward manage the affairs belonging to it, without the aſſiſtance of the reſt; and each has a court called the *wardmote*, as has been already deſcribed, for the management of its own affairs. The other, by the maſter, wardens, and court of aſſiſtants, of the incorporate companies; whoſe power reaches no further than over the members of their reſpective guilds or fraternities; except that in them is inveſted the power to chooſe repreſentatives in parliament for the city, and all thoſe magiſtrates and officers elected by a common-hall; which companies are inveſted with diſtinct powers, according to the tenor of their reſpective charters.

41 Military government.

The *military* government of the city is lodged in a lieutenancy, conſiſting of the lord-mayor, aldermen, and other principal citizens, who receive their authority by a commiſſion from the king. Thoſe have under their command the city trained bands, conſiſting of ſix regiments of foot, diſtinguiſhed by the names of the *white*, *orange*, *yellow blue*, *green*, and *red*, each cotaining eight companies of 150 men, amounting in all to 7200. Beſides thoſe ſix regiments, there is a corps, called the *artillery company*, from its being taught the military exerciſe in the artillery-ground. This company is independent of the reſt, and conſiſts of 700 or 800 volunteers. All theſe, with two regiments of foot of 800 men each commanded by the lieutenant of the Tower of London, make the whole militia of this city; which

which, excluſive of Weſtminſter and the borough of Southwark, amounts to about 10.000 men.

42 Trading companies. The *trading part* of the city of London is divided into 89 companies; though ſome of them can hardly be called ſo, becauſe they have neither charters, halls, nor liveries. Of theſe 89 companies 55 have each a hall for tranſacting the buſineſs of the corporation; and this conſiſts of a maſter or prime warden, a court of aſſiſtants, and livery.—Twelve of theſe companies are ſuperior to the reſt both in antiquity and wealth; and of one of thoſe 12 the lord mayors have generally made themſelves free at their election. Theſe companies are the mercers, grocers, drapers, fiſh-mongers, goldſmiths, ſkinners, merchant-taylors, haberdaſhers, ſalters, iron-mongers, vintners, and clothworkers.—The principal incorporated ſocieties of the merchants of this city are the Hamburgh Company, the Hudſons Bay Company, the Ruſſia Company, the Turkey Company, the Eaſt India company, the Royal African Company, the South Sea Company, and ſome Inſurance Companies. The moſt of theſe companies have ſtated houſes for tranſacting their buſineſs, particularly the Eaſt India and South Sea companies. See COMPANY.

The ſtreets and public buildings in London and its liberties being far too numerous for a particular deſcription in this work, we ſhall only ſelect the moſt remarkable, beginning with *London-bridge* as the moſt ancient, and proceeding in our ſurvey through the wards into which the city is divided.

43 Remarkable ſtreets and buildings within the City. I. *Remarkable buildings, &c. in the* CITY.—The original bridge, which ſtands in Bridge-ward, was of wood, and appears to have been firſt built between the years 993 and 1016; but being burnt down about the year 1136, it was rebuilt of wood in 1163. The expences, however, of maintaining and repairing it became ſo burdenſome to the inhabitants of the city, that they reſolved to build a ſtone-bridge a little weſtward of the wooden one. This building was begun in 1176, and finiſhed in 1209; and was 915 feet long, 44 feet high, and 73 feet wide; but houſes being built on each ſide, the ſpace between was only 23 feet.

44 London-bridge. This great work was founded on enormous piles driven as cloſely as poſſible together: on their tops were laid long planks 10 inches thick, ſtrongly bolted; and on them were placed the baſe of the pier, the lowermoſt ſtones of which were bedded in pitch, to prevent the water from damaging the work: round all were the piles which were called the *ſterlings*, deſigned for the preſervation of the foundation piles. Theſe contracted the ſpace between the piers ſo greatly, as to occaſion at the retreat of every tide a fall of five feet, or a number of temporary cataracts, which ſince the foundation of the bridge have occaſioned the loſs of many thouſand lives. The number of arches was 19, of unequal dimenſions, and greatly deformed by the ſterlings and the houſes on each ſide, which overhung and leaned in a moſt terrific manner. In moſt places they hid the arches, and nothing appeared but the rude piers. Within recollection, frequent arches of ſtrong timber croſſed the ſtreet from the top of the houſes to keep them together, and from falling into the river (A), Nothing but uſe could preſerve the quiet of the inmates, who ſoon grew deaf to the noiſe of the falling waters, the clamours of watermen, or the frequent ſhrieks of drowning wretches. In one part had been a drawbridge, uſeful either by way of defence or for the admiſſion of ſhips into the upper part of the river. This was protected by a ſtrong tower. It ſerved to repulſe Fauconbridge the Baſtard in his general aſſault on the city in 1471, with a ſet of banditti, under pretence of reſcuing the unfortunate Henry, then confined in the Tower. Sixty houſes were burnt on the bridge on the occaſion. It alſo ſerved to check, and in the end annihilate, the ill-conducted inſurrection of Sir Thomas Wyat, in the reign of Queen Mary. The top of this tower, in the ſad and turbulent days of this kingdom, uſed to be the ſhambles of human fleſh, and covered with heads or quarters of unfortunate partizans. Even ſo late as the year 1598, Hentzner the German traveller, with German accuracy, counted on it above 30 heads. The old map of the city in 1597 repreſents them in a moſt horrible cluſter.—An unparalleled calamity happened on this bridge within four years after it was finiſhed. A fire began on it at the Southwark end; multitudes of people ruſhed out of London to extinguiſh it; while they were engaged in this charitable deſign the fire ſeized on the oppoſite end, and hemmed in the crowd. Above 3000 perſons periſhed in the flames, or were drowned by overloading the veſſels which were hardy enough to attempt their relief.

The narrowneſs of the paſſage on this bridge having occaſioned the loſs of many lives from the number of carriages continually paſſing; and the ſtraitneſs of the arches, with the enormous ſize of the ſterlings, which occupied one-fourth part of the water-way, having alſo occaſioned frequent and fatal accidents as already mentioned; the magiſtrates of London in 1756 obtained an act of parliament for improving and widening the paſſage over and through the bridge, which granted them a toll for every carriage and horſe paſſing over it, and for every veſſel with goods paſſing through it: but theſe tolls proving inſufficient, were aboliſhed by an act made in 1758 for explaining, amending, and rendering the former act more effectual; and for granting the city of London money towards carrying on that

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(A) The gallant action of Edmund Oſborne, anceſtor to the duke of Leeds, when he was apprentice to Sir William Hewet cloth-worker, may not improperly be mentioned in this place. About the year 1536, when his maſter lived in one of theſe tremendous houſes, a ſervant-maid was playing with his only daughter in her arms in a window over the water, and accidentally dropt the child. Young Oſborne, who was witneſs to the misfortune, inſtantly ſprang into the river, and, beyond all expectation, brought her ſafe to the terrified family! Several perſons of rank paid their addreſſes to her when ſhe was marriageable, among others the earl of Shrewſbury; but Sir William gratefully decided in favour of Oſborne: *Oſborne*, ſays he, *ſaved her, and Oſborne ſhall enjoy her.* In her right he poſſeſſed a great fortune. He became ſheriff of London in 1575, and lord-mayor in 1582.

that work. In conſequence of theſe acts of parliament, a temporary wooden bridge was built, and the houſes on the old bridge were taken down. Inſtead of a narrow ſtreet 23 feet wide, there is now a paſſage of 31 feet for carriages, with a raiſed pavement of ſtone on each ſide ſeven feet broad for the uſe of foot paſſengers. The ſides are ſecured by ſtone baluſtrades, enlightened in the night with lamps. The paſſage thro' the bridge is enlarged by throwing the two middle arches into one, and by other alterations and improvements; notwithſtanding which, however, it is ſtill greatly ſubject to its former inconveniences.—Under the firſt, ſecond, and fourth arches, from the north ſide of the bridge, and now likewiſe towards the ſouthern extremity, there are engines worked by the flux and reflux of the river, the water of which they raiſe to ſuch a height as to ſupply many parts of the city. Thoſe engines were contrived in 1582 by one Peter Morice a Dutch man, and are called *London bridge water works*.

45 The Monument.

Near the north ſide of London bridge ſtands the *Monument*, a beautiful and magnificent fluted column of the Doric order, built with portland ſtone, and erected in memory of the conflagration 1666. It was begun by Sir Chriſtopher Wren in 1671, and finiſhed by him in 1677. Its height from the pavement is 202 feet; the diameter of the ſhaft or body of the column, is 15 feet; the ground, plinth, or loweſt part of the pedeſtal, is 28 feet ſquare; and the pedeſtal is 40 feet high. Over the capital is an iron balcony encompaſſing a cone 32 feet high, which ſupports a blazing urn of gilt braſs. Within is a large ſtair caſe of black marble, containing 345 ſteps, each 10 inches and a half broad, and ſix inches thick. The weſt ſide is adorned with a curious emblem in alt-relief denoting the deſtruction and reſtoration of the city. The firſt female figure repreſents London ſitting in ruins, in a languiſhing poſture, with her head dejected, her hair diſhevelled, and her hand careleſsly lying on her ſword: Behind is *Time*, gradually raiſing her up: at her ſide is a woman touching her with one hand, whilſt a winged ſcepter in the other directs her to regard the goddeſſes in the clouds; one with a cornucopia, denoting *Plenty*; the other with a palm branch, the emblem of *Peace*. At her feet is a bee-hive, ſhowing, that by induſtry and application the greateſt misfortunes are to be overcome. Behind the figure of *Time* are citizens exulting at his endeavours to reſtore her; and beneath, in the midſt of the ruins is a dragon, who as the ſupporter of the city arms, with his paw endeavours to preſerve the ſame. Oppoſite to the city, on an elevated pavement, ſtands, the king, in a Roman habit with a laurel on his head, and a truncheon in his hand, and approaching her, commands three of his attendants to deſcend to her relief. The firſt repreſents the *Sciences* with a winged head; and a circle of naked boys dancing thereon; and holding *Nature* in her hand, with her numerous breaſts, ready to give aſſiſtance to all. The ſecond is *Architecture*, with a plan in one hand, and ſquare and a pair of compaſſes in the other; and the third is *Liberty*, waving a hat in the air, ſhowing her joy at the pleaſing proſpect of the city's ſpeedy recovery. Behind the king ſtands his brother the duke of York, with a garland in one hand to crown the riſing city, and a ſword in the other for her defence. The two figures behind are *Juſtice* and *fortitude*; the former with a coronet, and the latter with a reined lion: and under the royal pavement lies *Envy*, gnawing a heart and inceſſantly emitting peſtiferous fumes from her mouth. On the plinth the reconſtruction of the city is repreſented by builders and labourers at work upon houſes. On the north, ſouth, and eaſt ſides, are inſcriptions relating to the deſtruction occaſioned by the conflagration, the regulations about rebuilding the city, and erecting the monument; and round it is the following one:—"This pillar was ſet up in perpetual remembrance of the moſt dreadful burning of this Proteſtant city, begun and carried on by the treachery and malice of the Popiſh faction, in the beginning of September, in the year of our Lord 1666, in order to their carrying on their horrid plot for extirpating the Proteſtant religion and *old Engliſh* liberty, and introducing Popery and ſlavery." Dr Wendeborn, in his account of London, obſerves, that the monument, though not much above 100 years old, bears viſible marks of decay already; and it will not probably be long before it muſt be pulled down. Some are of opinion that this is occaſioned by the fault of the architect, others by the continual ſhaking of the ground by coaches; but the Doctor inclines to the latter opinion.

46 The Tower

Eaſtward of the bridge and monument ſtands the *Tower*, which gives name to another ward. It is the chief fortreſs of the city, and ſuppoſed to have been originally built by William the Conqueror. It appears, however, to have been raiſed upon the remains of a more ancient fortreſs, erected probably by the Romans: for in 1720, in digging on the ſouth ſide of what is called *Cæſar's Chapel*, there were diſcovered ſome old foundations of ſtone, three yards broad, and ſo ſtrongly cemented that it was with the utmoſt difficulty they were forced up. The firſt work (according to Mr Pennant) ſeems to have been ſuddenly flung up in 1606 by the Conqueror, on his taking poſſeſſion of the capital; and included in it a part of the ancient wall.

The great ſquare tower, called the *White Tower*, was erected in the year 1078, when it aroſe under the directions of Gundulph biſhop of Rocheſter, who was a great military architect. This building originally ſtood by itſelf. Fitzſtephen gives it the name of *Arx Palatina*, "the Palatine Tower;" the commander of which had the title of Palatine beſtowed on him. Within this tower is a very ancient chapel for the uſe of ſuch of the kings and queens who wiſhed to pay their devotions here. In 1092 a violent tempeſt did great injury to the Tower; but it was repaired by William Rufus and his ſucceſſor. The firſt added another caſtellated building on the ſouth ſide between it and the Thames, which was afterwards called *St Thomas's Tower*.

The tower was firſt incloſed by William Longchamp, biſhop of Ely and chancellor of England, in the reign of Richard I. This haughty prelate having a quarrel with John, third brother to Richard, under pretence of guarding againſt his deſigns, ſurrounded the whole with walls embattled, and made on the outſide a vaſt ditch, into which, in after times, the water from the Thames was introduced. Different princes added other works. The preſent contents within the walls are 12 acres and 5 rods, the circuit on the outſide of the ditch 1052 feet. It was again incloſed with a mud-wall by Henry III. this was placed at a diſtance from the ditch, and occaſioned the taking down part of the city-wall, which was reſented by the citizens; who pulling down this precinct of mud, were puniſhed by the king with a fine of a thouſand merks.

The *Lions Tower* was built by Edward IV. it was originally called the *Bulwark*, but received the former name from its uſe A menagery had very long been a piece of regal ſtate: Henry I. had his at his manor of Woodſtock, where he kept lions, leopards, lynxes, porcupines, and ſeveral other uncommon beaſts. They were afterwards removed to the Tower. Edward II. commanded the ſheriffs of London to pay the keepers of the king's leopards ſixpence a day for the ſuſtenance of the leopards, and three halfpence a day for the diet of the keeper out of the fee-farm of the city. The royal menagery is to this day exceedingly well ſupplied.

In 1758 the Tower ditch was railed all round. New barracks were ſome years ago erected on the Tower-wharf, which parts it from the river; and upon the wharf is a line of 16 pieces of cannon, which are fired upon ſtate holidays. On this ſide of the Tower the ditch is narrow, and over it is a draw-bridge. Parallel to the wharf, within the walls, is a platform 70 yards in length, called the *Ladies Line*, becauſe much frequented by the ladies in the ſummer: it being ſhaded in the inſide with a row of lofty trees, and without it is a delightful proſpect of the ſhipping with boats paſſing and repaſſing on the river Thames. You aſcend this line by ſtone ſteps, and being once upon it you may walk almoſt round the walls of the Tower without interruption.

The principal entrance into the Tower is by a gate to the weſt, large enough to admit coaches and heavy carriages but theſe are firſt admitted through an outward gate, ſituated without the ditch upon the hill, and muſt paſs a ſtout ſtone-bridge built over the ditch before they can approach the main entrance. There is, beſides, an entrance near the very ſouth-weſt corner of the tower outward wall, for perſons on foot, over the draw-bridge already mentioned to the wharf. There is alſo a water-gate, commonly called *Traitor's gate*, through which it has been cuſtomary to convey traitors and other ſtate-priſoners to or from the Tower and which is ſeldom opened on any other occaſion: but the lords committed to the Tower in 1746 were publickly admitted at the main entrance. Over this gate is a regular building, terminated at each end by two round towers, on which are embraſures for pointing cannon. In this building there are the infirmary, the mill, and the water-works that ſupply the Tower with water.

In the Tower (the curioſities of which are more particularly deſcribed in the note (B), are a church,

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(B) In examining the curioſities of the Tower of London, it will be proper to begin with thoſe on the outſide of the principal gate. The firſt thing a ſtranger uſually goes to viſit is the wild beaſts; which, from their ſituation firſt preſent themſelves: for having entered the outer gate, and paſſed what is called the ſpur-guard, the keeper's houſe preſents itſelf before you, which is known by a painted lion on the wall, and another over the door which leads to their dens. By ringing a bell, and paying ſixpence each perſon, you may eaſily gain admittance.

The next place worthy of obſervation is the Mint, which comprehends near one-third of the Tower and contains houſes for all the officers belonging to the coinage. On paſſing the principal gate you ſee the White Tower, built by William the Conqueror. This is a large, Square, irregular ſtone building, ſituated almoſt in the center, no one ſide anſwering to another nor any of its watch-towers, of which there are four at the top, built alike. One of theſe towers is now converted into an obſervatory. In the firſt ſtory are two noble rooms, one of which is a ſmall armory for the ſea-ſervice, it having various ſorts of arms, very curiouſly laid up, for above 10,000 ſeamen. In the other room are many cloſets and preſſes, all filled with warlike engines and inſtruments of death. Over this are two other floors, one principally filled with arms; the other with arms and other warlike inſtruments, as ſpades, ſhovels, pick-axes, and chevaux de frize. In the upper ſtory are kept match, ſheep-ſkins, tanned hides, &c. and in a little room called Julius Cæſar's chapel, are depoſited ſome records, containing perhaps the ancient uſages and cuſtoms of the place. In this building are alſo preſerved the models of the new-invented engines of deſtruction that have have from time to time been preſented to the government. Near the ſouth weſt angle of the White Tower is the Spaniſh armoury, in which are depoſited the ſpoils of what was vainly called the Invincible Armada: in order to perpetuate to the lateſt poſterity the memory of that ſignal victory obtained by the Engliſh over the whole naval power of Spain in the reign of Philip II.

You are now come to the grand ſtore-houſe, a noble building to the northward of the White Tower that extends 245 feet in length and 60 in breadth. It was begun by king James II. who built it to the firſt floor, but it was finiſhed by king William III. who erected that magnificent room called the New or Small Armoury, in which that prince, with queen Mary his conſort, dined in great form, having all the warrant workmen and labourers to attend them, dreſſed in white gloves and aprons, the uſual badges of the order of maſonry. To this noble noble room you are led by a folding door, adjoining to the eaſt end of the Tower chapel, which leads to a grand ſtair-caſe of 50 eaſy ſteps. On the left ſide of the uppermoſt landing-place is the work-ſhop, in which are conſtantly employed about 14 furbiſhers, in cleaning, repairing, and new-placing the arms. On entering the armoury, you ſee what they call a wilderneſs of arms, ſo artfully diſpoſed, that at one view you behold arms for near 80,000 men, all bright, and fit for ſervice; a ſight which it is impoſſible to behold without aſtoniſhment; and beſide thoſe expoſed to view, there were before the late war, 16 cheſts

London. the offices of ordinance and of the mint, thoſe of the keepers of the records, of the jewel-office, of the Spaniſh armoury, the horſe armoury, and the new or ſmall armoury; the barracks of the ſoldiers of the garriſon, and handſome houſes for ſeveral officers who reſide here. The principal officers of the Tower are, a conſtable, a lieutenant, and a deputy-lieutenant. Belonging to this fortreſs are eleven hamlets; the militia of which, conſiſting of 400 men, are obliged, at the command of the conſtable of the Tower, to repair hither, and reinforce the garriſon.

47 Victualling office. On Little Tower-hill is the *Victualling-office* for the navy,

ſhut up, each cheſt holding about 1000 muſkets. The arms were originally diſpoſed by Mr. Harris, who contrived to place them in this beautiful order, both here and in the guard chamber of Hampton-court. He was a common gunſmith; but after he had performed this work, which is the admiration of people of all nations, he was allowed a penſion from the crown for his ingenuity.

Upon the ground floor, under the ſmall armoury, is a large room of equal dimenſions with that, ſupported by 20 pillars, all hung round with implements of war. This room, which is 24 feet high, has a paſſage in the middle 16 feet wide. At the ſight of ſuch a variety of the moſt dreadful engines of deſtruction, before whoſe thunder the moſt ſuperb edifices, the nobleſt works of art, and numbers of the human ſpecies, fall together in one common and undiſtinguiſhed ruin; one cannot help wiſhing that thoſe horrible inventions had ſtill lain, like a falſe conception, in the womb of nature, never to have been ripened into birth.

The horſe armoury is a plain brick building, a little to the eaſtward of the White-Tower; and is an edifice rather convenient than elegant, where the ſpectator is entertained with a repreſentation of thoſe kings and heroes of the nation, with whoſe gallant actions it is to be ſuppoſed he is well acquainted; ſome of them equipped and ſitting on horſeback, in the ſame bright and ſhining armour they were uſed to wear when they performed thoſe glorious actions which gave them a diſtinguiſhed place in the Britiſh annals.

You now come to the line of kings, which your conductor begins by reverſing the order of chronology; ſo that in following them we muſt place the laſt firſt.

In a dark, ſtrong ſtone room, about 20 yards to the eaſtward of the grand ſtorehouſe, or new armoury, the crown jewels are depoſited. 1. The imperial crown, with which it is pretended that all the kings of England have been crowned ſince Edward the Confeſſor in 1040. It is of gold, enriched with diamonds, rubies, emeralds, ſapphires, and pearls: the cap within is of purple velvet, lined with white taffety, turned up with three rows of ermine. They are, however, miſtaken in ſhowing this as the ancient imperial diadem of St Edward: for that, with the other moſt ancient regalia of the kingdom, was kept in the arched room in the cloiſters of Weſtminſter Abbey till the civil war; when, in 1642, Harry Martin, by order of the parliament, broke open the iron cheſt in which it was ſecured, took it thence, and ſold it, together with the robes, ſword, and ſceptre, of St Edward. However, after the Reſtoration, king Charles II. had one made in imitation of it, which is that now ſhown. 2. The golden orb, or globe, put into the king's right hand before he is crowned; and borne in his left hand, with the ſceptre in his right, upon his return into Weſtminſter-hall after he is crowned. It is about ſix inches in diameter, edged with pearl, and enriched with precious ſtones. On the top is an amethyſt, of a violet colour, near an inch and an half in height, ſet with a rich croſs of gold, adorned with diamonds, pearls, and precious ſtones. The whole height of the ball and cap is 11 inches. 3. The golden ſceptre, with its croſs ſet upon a large amethyſt of great value, garniſhed round with table diamonds. The handle of the ſceptre is plain, but the pummel is ſet round with rubies, emeralds, and ſmall diamonds. The top riſes into a *a fleur de lis* of ſix leaves, all enriched with precious ſtones, from whence iſſues a mound or ball, made of the amethyſt already mentioned. The croſs is quite covered with precious ſtones. 4. The ſceptre, with the dove, the emblem of peace, perched on the top of a ſmall Jeruſalem croſs, finely ornamented with table diamonds and jewels of great value. This emblem was firſt uſed by Edward the Confeſſor, as appears by his ſeal; but the ancient ſceptre and dove was ſold with the reſt of the regalia, and this now in the Tower was made after the Reſtoration. 5. St Edward's ſtaff, four feet ſeven inches and an half in length, and three inches three quarters in circumference, all of beaten gold, which is carried before the king at his coronation. 6. The rich crown of ſtate, worn by his majeſty in parliament; in which is a large emerald ſeven inches round; a pearl eſteemed the fineſt in the world; and a ruby of ineſtimable value. 7. The crown belonging to his royal highneſs the prince of Wales. The king wears his crown on his head when he ſits upon his throne; but that of the prince of Wales is placed before him, to ſhow that he is not yet come to it. 8. The late queen Mary's crown, globe, and ſceptre, with the diadem ſhe wore at her coronation with her conſort king William III. 9. An ivory ſceptre, with a dove on the top, made for king James II.'s queen, whoſe garniture is gold, and the dove on the top gold enamelled with white. 10. The *curtana*, or ſword of mercy, which has a blade of 32 inches long, and near two broad, is without a point, and is borne naked before the king at his coronation, between the two ſwords of juſtice, ſpiritual and temporal. 11. The golden ſpurs, and armillas, which are bracelets for the wriſts. Theſe, though very antique, are worn at the coronation. 12. The *ampulla*, or eagle of gold, finely engraved, which holds the holy oil the kings and queens of England are anointed with; and the golden ſpoon that the biſhop pours the oil into. Theſe are two pieces of great antiquity. The golden eagle, including the pedeſtal, is about nine inches high, and the wings expand about ſeven inches. The whole weighs about ten ounces. The head of the eagle ſcrews off about the middle of the neck, which is made hollow, for holding the holy oil; and when the king is anointed by the biſhop, the oil is poured into the ſpoon out of the bird's bill. 13. A rich

ſaltſeller

navy. It is ſeparated from Tower-hill by a wall and gate, and contains houſes for the officers, ſlaughter-houſes, ſtore-rooms, a brew-houſe, a ſalting-houſe, and a barrelling-houſe; under the direction of ſeven commiſſioners and other inferior officers.

48 Cuſtom-houſe. In the Tower ward is alſo the *Cuſtom houſe*, a large, handſome, and commodious building of brick and ſtone. It ſtands upon the banks of the Thames, and is accommodated with large wharfs, keys, and ware-houſes. On this ſpot is the buſy concourſe of all nations, who pay their tribute towards the ſupport of Great-Britain. About the year 1559, the loſs of the revenue, by collecting it in different parts of the city, was firſt diſcovered, and an act paſſed to compel people to land their goods in ſuch places as were appointed by the commiſſioners of the revenue; and this was the ſpot fixed on: A cuſtom-houſe was erected; which being deſtroyed by the great fire, was rebuilt by Charles II. In 1718 it underwent the ſame fate, and was reſtored in its preſent form. Before the cuſtom-houſe was eſtabliſhed here, the principal place for receiving the duties was at Billingſgate. In 1268 the half year's cuſtoms for foreign merchandiſe in the city of London came only to L. 75 : 6 : 10; the annual produce of the cuſtoms, ending in April 1789, amounted to L. 3,711,126.

49 Trinity Houſe. In Water-lane, a little to the north-weſt of the cuſtom-houſe, is the *Trinity houſe*; a ſociety founded in 1515, at a period in which the Britiſh navy began to aſſume a ſyſtem. The founder was Sir Thomas Spert comptroller of the navy, and commander of the great ſhip Henry Grace de Dieu. It is a corporation, conſiſting of a maſter, four wardens, eight aſſiſtants, and eighteen elder brethren; ſelected from commanders in the navy and the merchants ſervice; and now and then a compliment is paid to one or two of the firſt nobility. They may be conſidered as guardians of the ſhips, military and commercial. Their powers are very extenſive: they examine the mathematical children of Chriſt's hoſpital, and the maſters of his majeſty's ſhips; they appoint pilots for the river Thames; ſettle the general rates of pilotage; erect light-houſes and ſea-marks; grant licences to poor ſeamen, not free of the city, to row on the Thames; prevent foreigners from ſerving on board the ſhips without licence; puniſh ſeamen for mutiny and deſertion; hear and determine complaints of officers and men in the merchants ſervice, but liable to appeal to the judge of the court of admiralty, ſuperintend the deepening and cleanſing of the river Thames, and have under their juriſdiction the ballaſt office; have powers to buy lands, and receive donations for charitable uſes; and, in conſequence, relieve annually many thouſands of poor ſeamen, their widows, and orphans. It is in this houſe the buſineſs of the inſtitution is carried on: but the mother houſe is at Deptford, the corporation being named, "the maſter, wardens, and aſſiſtants of the guild or fraternity of the moſt glorious and undivided Trinity, and of St Clement, in the pariſh of Deptford Strond, in the county of Kent."

50 The Minories. Between Aldgate and the Tower is the ſtreet called the *Minories*, from ſome poor ladies of the order of St Clare, or minoreſſes. They had been invited to London by Blanch queen of Navarre, and wife to Edmund earl of Lancaſter, who founded a convent for them in 1293. On the ſuppreſſion of the monaſteries it was converted into a dwelling-houſe for ſome of the nobility, and is now in the poſſeſſion of the Dartmouth family. Till of late years, the Minories were but a deſpicable ſtreet; but have now been excellently rebuilt, and are as elegant as any in the city.

On the weſt ſide of the city-walls at this place, ſtood the houſe of the *Crutched* or *Croſſed Friars*, an order inſtituted at Bologne in 1169, and of which a branch ſettled in England in 1244, where they were accommodated with an houſe in this place by two citizens named *Ralph Hoſier* and *William Sabernas*, who became members

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ſaltſeller of ſtate, in form like the ſquare White Tower, and ſo exquiſitely wrought, that the workmanſhip of modern times is in no degree equal to it. It is of gold, and uſed only on the king's table at the coronation. 14. A noble ſilver font, double gilt, and elegantly wrought, in which the royal family are chriſtened. 15. A large ſilver fountain, preſented to king Charles II. by the town of Plymouth, very curiouſly wrought; but much inferior in beauty to the above. Beſides theſe, which are commonly ſhown, there are in the jewel office all the crown jewels worn by the princes and princeſſes at coronations, and a great variety of curious old plate.

The record office conſiſts of three rooms, one above another, and a large round room, where the rolls are kept. Theſe are all handſomely wainſcotted, the wainſcot being framed into preſſes round each room, within which are ſhelves and repoſitories for the records; and for the eaſier finding of them, the year of each reign is inſcribed on the inſide of theſe preſſes, and the records placed accordingly. Within theſe preſſes, which amount to 56 in number, are depoſited all the rolls, from the firſt year of the reign of king John to the beginning of the reign of Richard III. but thoſe after this laſt period are kept in the Rolls Chapel. The records in the Tower, among other things, contain the foundation of abbeys and other religious houſes; the ancient tenures of all the lands in England, with a ſurvey of the manors; the original of laws and ſtatutes; proceedings of the courts of common law and equity; the rights of England to the dominion of the Britiſh ſeas; leagues and treaties with foreign princes; the atchievements of England in foreign wars; the ſettlement of Ireland, as to law and dominion; the forms of ſubmiſſion of ſome Scottiſh kings for territories held in England; ancient grants of the kings to their ſubjects; privileges and immunities granted to cities and corporations during the period above mentioned; inrolments of charters and deeds made before the Conqueſt; the bounds of all the foreſts in England, with the ſeveral reſpective rights of the inhabitants to common paſture, and many other important records, all regularly diſpoſed, and referred to in near a thouſand folio indexes. This office is kept open, and attendance conſtantly given, from ſeven o'clock till one, except in the months of December, January, and February, when it is open only from eight till one, Sundays and holidays excepted. A ſearch here is half a guinea, for which you may peruſe any one ſubject a year.

51 India Company's warehouſes

members of their order. Henry VIII. granted their houſe to Sir Thomas Wyatt the elder, who built a handſome manſion on part of the ground where it ſtood. This manſion became afterwards the reſidence of John Lord Lumley, a celebrated warior in the time of Henry VIII. In proceſs of time, it was converted into a navy-office: but this office being removed to Somerſet-houſe, the India Company have erected in its place a moſt magnificent warehouſe, in form of an oblong ſquare of about 250 feet by 160, incloſing a court of 150 by 60 feet, the entrance to which is by an arched gateway.

52 Billingſgate.

Billingſgate ward is diſtinguiſhed by its *market*. *Billingſgate* was a ſmall port for the reception of ſhipping, and for a conſiderable time the moſt important place for the landing of almoſt every article of commerce. In the time of King William, Billingſgate began to be celebrated as a fiſh-market. In 1699 it was by act of parliament made a free port for fiſh to be ſold there every day except Sunday; but Mr Pennant informs us, that the object of this has long been fruſtrated, and that fiſh are now no longer to be had there in perfection. The ſame author gives a liſt of the fiſh which in the time of Edward III. were brought to London market; the monarch himſelf having condeſcended to regulate the prices, that his ſubjects might not be impoſed upon by thoſe who ſold them. Among theſe were the conger-eel and porpoiſe, neither of which is now admitted to any table. A pike at that time coſt 6s. 8d.; whence our author concludes, that it was an exotic fiſh, and brought over at a vaſt expence. Some fiſhes are mentioned in his liſt with which this naturaliſt owns himſelf unacquainted, *viz.* the *barkey*, *bran*, *batrile*, *cropling*, and *rumb*. In Archbiſhop Nevill's great feaſt is mentioned alſo a fiſh named *thirle-poole*, unknown at preſent. Seals were formerly accounted a fiſh; and theſe, together with the ſturgeon and porpoiſe, were the only freſh fiſh permitted by the 33d of Henry VIII. to be bought of any ſtranger at ſea between England, France, Flanders, and Zealand.

53 Leadenhall

Limeſtreet ward is remarkable for a very large building, of great antiquity, called *Leadenhall*, with flat battlements leaded on the top, and a ſpacious ſquare in the middle. In 1309 it was the houſe of Sir Hugh Nevil knight; in 1384, of Humphry Bohun Earl of Hereford; in 1408 it became the property of the celebrated Whittington, who preſented it to the mayor and commonality of London; and in 1419, a public granary was erected here by Sir Simon Eyre, a citizen and draper, who built it with ſtone in its preſent form. This granary was deſigned as a preſervative againſt famine, and to be kept always full of corn, which deſign was for ſome time happily anſwered. The houſe came to be uſed for many other purpoſes beſides that of a granary; as for keeping the artillery and arms of the city. Preparations for any kind of pageantry or triumph were alſo made here; and from its ſtrength the place was conſidered as the chief fortreſs within the city in caſe of any popular inſurrection, and was likewiſe the place from whence alms were diſtributed. In this edifice are warehouſes for the ſale of leather, Colcheſter baize, meal, and wool. Adjoining to Leadenhall is a market, thence called *Leadenhall market*, conſiſting of five conſiderable ſquares or courts, and reckoned one of the greateſt markets in Europe for fleſh and other proviſions; as well as for leather, green hides and wool. A little to the eaſtward is the *India-houſe*, built in 1726, on the ſpot occupied by Sir William Craven, mayor, in 1610. According to Mr Pennant, this houſe "is not worthy of the lords of Indoſtan."

54 The India-Houſe.

55 Bank of England.

In Broadſtreet is the *Bank of England*, a ſtone building, which occupies one ſide of Three-needle ſtreet. The centre, and the building behind, were founded in the year 1733; the architect George Sampſon. Before that time the buſineſs was tranſacted in Grocers-hall. The front is a ſort of veſtibule; the baſe ruſtic, the ornamental columns above Ionic. Within is a court leading to a ſecond elegant building, which contains a hall and offices, where the debt of above 250 milions is punctually diſcharged. Of late years two wings of uncommon elegance, deſigned by Sir Robert Taylor, have been added at the expence of a few houſes, and of the church of St Chriſtopher's le Stocks. "The name of the projector of this national glory (ſays Mr Pennant), was Mr James Paterſon of Scotland. This palladium of Britain was in 1780 ſaved from the fury of an infamous banditti by the virtue of its citizens, who formed ſuddenly a volunteer company, and over-awed the miſcreants; while the chief magiſtrate ſkulked, trembling in his manſion-houſe, and left his important charge to its fate. This important building has ever ſince been very properly guarded by the military; who, in paſſing through the city, have often given offence to many buſy characters who would ſtrive to preſerve the city rights at the expence of the national deſtruction. A lord mayor was the laſt who intereſted himſelf by applying to Mr Grenville, who gave him to underſtand, that if the guards were not quietly permitted to diſcharge their duty, the bank would be removed to Somerſet-houſe."

56 Merchant-Taylors Hall, &c.

At the extremity of Three-needle ſtreet is *Merchant-Taylors Hall*. In this ſtreet alſo is the *South-Sea Houſe*, firſt eſtabliſhed in 1711 for the purpoſe of an excluſive trade to the South Sea, and for ſupplying Spaniſh America with negroes.

Near the junction of Throgmorton ſtreet with Broadſtreet ſtood a magnificent houſe built by Cromwell earl of Eſſex; after whoſe fall, the houſe and gardens were bought by the Drapers company. The houſe was deſtroyed in the great fire, but rebuilt for the uſe of the company in a magnificent manner.

57 St Giles's.

Mr Pennant informs us, that *St Giles's church* in the fields, and a few houſes to the weſt of it, in the year 1600, was barely ſeparated from Broad-ſtreet. The church is ſuppoſed to have belonged to an hoſpital for lepers, founded about the year 1117, by Matilda queen to Henry I. In ancient times it was cuſtomary here to preſent to malefactors, on their way to the gallows (which, about the year 1413, was removed from Smithfield, and placed between St Giles's high-ſtreet and Hog-lane (c), a great bowl of ale, as the laſt refreſhment they were to receive in this life. On the

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(c) This late place of execution, according to Mr Pennant, was called in the time of Edwdard III. when the

the door to the church-yard is a curious piece of ſculpture, repreſenting the laſt day, containing an amazing number of figures, ſet up about the year 1686. This church was rebuilt in 1625. By the amazing raiſing of the ground by filth and various adventitious matter, the floor in the year 1730 was eight feet below the ſurface acquired in the intervening time. This alone made it neceſſary to rebuild the church in the preſent century. The firſt ſtone was laid in 1730; it was furniſhed in 1734, at the expence of 10,000l.—In the church-yard is a great ſquare pit, with many rows of coffins piled one upon the other, all expoſed to ſight and ſmell, the latter of which is highly offenſive if not dangerous.

58 Wincheſter-Houſe.

On the weſt ſide of Broad-ſtreet ſtood the houſe of the Auguſtines, founded by Humphrey Bohun Earl of Somerſet in 1253, for friars and hermits of the Auguſtine order. On the diſſolution of the monaſteries, great part of the houſe was granted to William Lord St John, afterwards Marquis of Wincheſter, and Lord Treaſurer, who founded a magnificent houſe named *Wincheſter-houſe.* The weſt end of the church was granted in 1551 to John a Laſco for the uſe of the Germans and other fugitive Proteſtants, and afterwards to the Dutch as a place for preaching. A part of it was alſo converted into a glaſs-houſe for Venice glaſs, in which the manufacture was carried on by artiſts from that city, and patroniſed by the duke of Buckingham. The place was afterwards converted into *Pinners-hall,* belonging to the company of pin makers.

59 Greſham College.

60 Exciſe Office.

To the eaſtward of Wincheſter-ſtreet ſtood the houſe of that very eminent merchant Sir Thomas Greſham, afterwards known by the name of *Greſham college*: (See Gresham.) It has been pulled down not many years ago; and the *Exciſe Office,* a moſt magnificent and at the ſame time ſimple building, roſe in its place. Mr Pennant informs us, that from the 5th of January 1786 to January 5th 1787, the payments into this office amounted to no leſs than L. 5,531,114 : 6 : 10½.

61 Royal Exchange.

The *Royal Exchange,* which is the meeting place of the merchants of London, ſtands in the ward of Cornhill, and is the fineſt and ſtrongeſt fabric of the kind in Europe. It was founded in the year 1566. Sir Thomas Greſham, merchant in London, made an offer to the lord mayor and citizens, to build at his own expence a commodious edifice for merchants to meet and tranſact buſineſs, provided the city would find him a convenient ſituation for the ſame. Mr Pennant informs us, that one Richard Clough a Welſhman, originally Sir Thomas's ſervant, firſt put him on the deſign by a letter from Antwerp, in which he reproached the London merchants with having no place to tranſact their buſineſs, but walking about in the rain, more like pedlars than merchants. The citizens, in compliance with Sir Thomas's deſire, purchaſed, for the ſum of L. 3532, 80 houſes in the two alleys called *New St Chriſtopher's,* and *Swan-alley,* leading out of Cornhill into Three-needle ſtreet. The materials of thoſe houſes were ſold for L. 478, and the ground, when cleared, was conveyed to Sir Thomas Greſham, who accompanied by ſeveral aldermen, laid the firſt brick of the new building on the 7th of June that year. Each alderman alſo laid his brick, and left a piece of gold for the workmen; who ſet about it with ſuch aſſiduity and reſolution, that the whole fabric was roofed by the month of November 1567, and was ſoon after completed under the name of the *Burſe.* This building was totally deſtroyed by the fire in 1666; and in its place the preſent magnificent ſtructure was erected at the expence of L. 80,000, which ſtands upon a plat of ground 203 feet in length and 171 in breadth, containing an area in the middle, of 61 ſquare perches, ſurrounded with a ſubſtantial and regular ſtone building, wrought in ruſtic. It has two fronts, north and ſouth, each of which is a piazza; and in the centre are the grand entrances into the area, under a very lofty and noble arch. The ſouth front in Cornhill is the principal; on each ſide of which are Corinthian demi-columns, ſupporting a compaſs pediment; and, in the intercolumniation on each ſide, in the front next the ſtreet, is a niche, with the ſtatues of King Charles I. and II. in the Roman habits, and well executed. Over the aperture, on the cornice between the two pediments, are the king's arms in relievo: on each ſide of this entrance is a range of windows placed between demi-columns, and pilaſters of the compoſite order, above which runs a baluſtrade. This building is 56 feet high: and from the centre, in this front, riſes a lanthorn and turret 178 feet high, on the top of which is a fane of gilt braſs made in the ſhape of a graſshopper, the creſt of Sir Thomas Greſham's arms. The north front in Three-needle-ſtreet is adorned with pilaſters of the compoſite order; but has neither columns nor ſtatues on the outſide; and has triangular, inſtead of compaſs, pediments. The inſide of the area is alſo ſurrounded with piazzas, forming ambulatories for merchants, &c. to ſhelter themſelves from the weather, when met there upon buſineſs. Above the arches of this piazza is an entablature with curious ornaments; and on the cornice a range of pilaſters with an entablature extending round, and a compaſs pediment in the middle of the cornice of each of the four ſides. Under the pediment on the north ſide are the king's arms; on the ſouth, the city's arms; on the eaſt, Sir Thomas Greſham's arms; and on the weſt, the mercer's arms, with their reſpective enrichments. In theſe intercolumns are 24 niches, 20 of which are filled with the ſtatues of the kings and queens of England.

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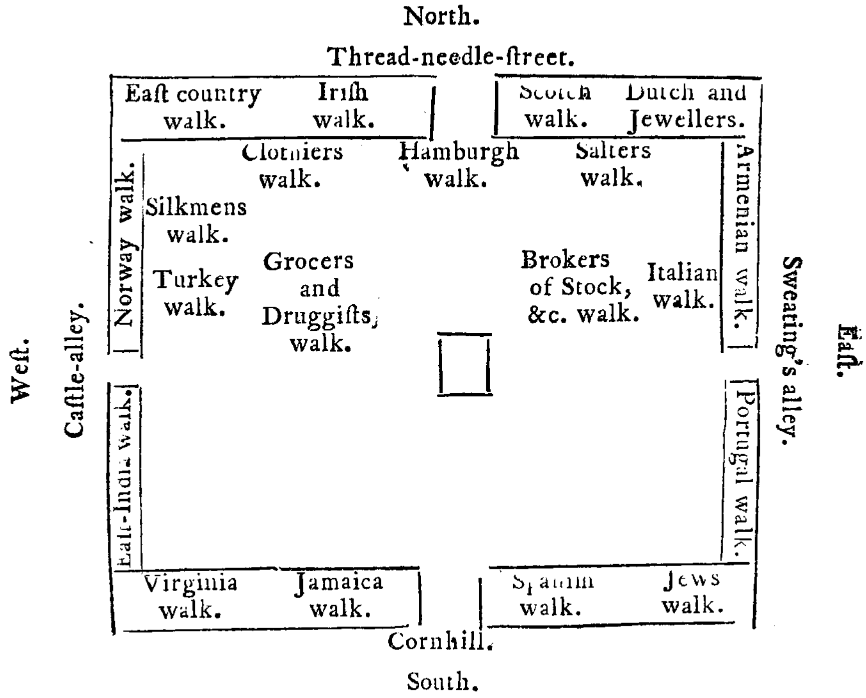
the gentle Mortimer finiſhed his days here, *the Elms*: but the original as well as the preſent name was *Tybourne*; not from *tye* and *burn,* as if it were called ſo from the manner of capital puniſhments; but from *bourne,* the Saxon word for a "Brook," and *Tye* the name of that brook, which joined gave name to a manor before the conqueſt. Here was alſo a village and church denominated *St John the Evangeliſt,* which fell to decay, and was ſucceeded by that of *Mary bourne,* corrupted into *Mary-la-bonne.* In 1636, Queen Henrietta Maria was compelled by her prieſts to take a walk by way of penance to Tyburn. What her offence was we are not told; but Charles was ſo diſguſted at this inſolence, that he ſoon after ſent them and all her majeſty's French ſervants out of the kingdom.

land. Under theſe piazzas, within the area, are 28 niches, all vacant but that in which Sir Thomas Greſham's ſtatue is placed in the north-weſt angle, and that in the ſouth-weſt, where the ſtatue of Sir John Barnard was placed in his lifetime by his fellow-citizens to expreſs their ſenſe of his merit. The centre of this area alſo is ornamented with a ſtatue of king Charles II. in a Roman habit, ſtanding upon a marble pedeſtal about eight feet high, and encompaſſed with iron rails; which pedeſtal is enriched on the ſouth ſide with an imperial crown, a ſceptre, ſword, palm-branches, and other decorations, with a very flattering inſcription to the king. On the weſt ſide is a cupid cut in relievo, reſting his right hand on a ſhield with the arms of France and England quartered, and holding a roſe in his left hand. On the north ſide is another cupid ſupporting a ſhield with the arms of Ireland; and on the eaſt ſide are the arms of Scotland, with a cupid holding a thiſtle; all done in relievo: the whole executed by that able ſtatuary Mr Gibbon.

In this area, merchants, and ſuch as have buſineſs with them, meet every day at change hours; and for the more regular and readier diſpatch of buſineſs, they diſpoſe of themſelves into ſeparate walks, according to the following plan.



In building this expenſive ſtructure there was an eye not only to magnificence, and to accommodate the merchants, but alſo to reimburſe the expence. For this reaſon a gallery was built over the four ſides of the royal exchange. This was divided into 200 ſhops which were let out to haberdaſhers, milliners, &c. and which for ſeveral years were well occupied. But theſe ſhops have now for a long time been deſerted, and the galleries are let out to the Royal Exchange Aſſurance-office, the Merchant-ſeamens office, the Marine Society, and to auctioneers, &c. Under the whole area there are the fineſt dry vaults that can be found any where, which are let out to the Eaſt-India company to depoſit their pepper. In the turret is a good clock with four dials, which is well regulated every day, ſo that it becomes a ſtandard of time to all the mercantile part of the town: and it goes with chimes at three, ſix, nine, and twelve o'clock, playing upon twelve bells. The outſide of this grand fabric ſuffers very much in its elegance from the ſhops that ſurround it, and are built within its walls; and which are occupied by bookſellers, toymen, cutlers, hoſiers, watchmakers, &c.

62 General Poſt-Office

South of the Royal-Exchange, and near the weſt extremity of Lombard-ſtreet, is the *General Poſt Office*, which is a handſome and commodious building.

63 The Manſion-houſe.

In Walbrook ward is the *Manſion-houſe*, for the reſidence of the lord-mayor. This edifice was begun in 1739, and finiſhed in 1753. It is built of Portland ſtone, with a portico of ſix fluted columns, of the Corinthian order, in the front. The baſement ſtory is very maſſy, and conſiſts of ruſtic work; in the centre of it is the door, which leads to the kitchens, cellars, and other offices. On each ſide riſes a flight of ſteps, leading up to the portico, in the middle of which is the principal entry. The ſtone baluſtrade of the ſtairs is continued along the front of the portico, and the columns ſupport a large angular pediment, adorned with a group of figures in baſs relief, repreſenting the dignity and opulence of the city of London. It is an extreme heavy building, of an oblong form, and its depth is the long ſide, having ſeveral magnificent apartments, which are not, however, well lighted, on account of houſes that ſurround it.

64 St Stephen's Church.

Behind the manſion-houſe is *St Stephen's Church*, in Walbrook, juſtly reputed the maſter-piece of the celebrated Sir Chriſtopher Wren, and is ſaid to exceed every modern ſtructure in the world in proportion and elegance.

The manſion-houſe, and many adjacent buildings, ſtand on the place where the *Stocks market* once ſtood. This took its name from a pair of ſtocks erected near the ſpot in 1281; and was the great market of London for proviſions during many centuries.

65 London-ſtone.

In this ward is ſituated one of the moſt remarkable pieces of antiquity in London. It is a great ſtone, now ſtanding in a caſe on the north ſide of Canon-ſtreet, cloſe under the ſouth wall of St Swithin's church. It is called *London-ſtone;* and was formerly pitched edgeways on the other ſide of the ſtreet, oppoſite to where it now ſtands, fixed deeply in the ground, and ſtrongly faſtened with iron bars; but for the conveniency of wheel-carriages it was removed to its preſent ſituation. This ſtone is mentioned ſo early as the time of Athelſtan, king of the Weſt Saxons, and has been carefully preſerved from age to age. Of the original cauſe of its erection no memorial remains; but it is conjectured, that as London was a Roman city, this ſtone might be the centre, and might ſerve as an object from which the diſtance was computed to the other conſiderable cities or ſtations in the province.

66 Merchant-Taylors School.

In Dowgate ward is a noted academy, called *Merchant-taylors School,* from its having been founded by the merchant-taylors company, in the year 1561. It was deſtroyed by the fire of London in 1666, but was rebuilt, and is a very large ſtructure, with commodious apartments for the maſters and uſhers, and a fine library. Sir Thomas White, lord mayor of this city, having founded St John's college in Oxford in 1557, appointed this ſchool as a ſeminary for it, and eſtabliſhed at Oxford 46 fellowſhips for ſcholars elected from this ſchool.

67 St Mary le Bow.

The church of *St Mary le Bow,* in Cordwainers-ſtreet ward, is the moſt eminent parochial church in the city. It was originally built in the reign of William the Conqueror; and being the firſt church the ſteeple of which was embelliſhed with ſtone arches or bows, took thence its denomination of le Bow. It was burnt down in the fire of 1666, but ſoon afterwards rebuilt. The ſteeple of this church is reckoned the moſt beautiful of its kind in Europe.

68 Guildhall.

In Cheap ward is *Guildhall,* or the town-houſe of London. This was originally built in 1411, but ſo damaged by the great fire already mentioned, as to be rebuilt in 1669. The front has a Gothic appearance; and this character is alſo due to the two gigantic effigies which ſtand within the hall. The hall is 153 feet long, 50 broad, and 55 high, adorned with the royal arms, and thoſe of the city and its companies, as well as with ſeveral portraits of Engliſh ſovereigns and judges. In this building are many apartments for tranſacting the buſineſs of the city, beſides one for each of the judicial courts, namely, that of the King's-Bench, the Common-Pleas, and the Exchequer.

69 Cheapſide.

In the year 1246 Cheapſide was an open field, named *Crown field,* from an inn with the ſign of the crown. At that time, and even for 200 years afterwards, none of the ſtreets of London were paved excepting Thames-ſtreet, and from Ludgate-hill to Charing Croſs.

75 Goldſmiths Hall.

71 St Martins le Grand.

Goldſmiths Hall ſtands in Foſter-lane, which opens into the weſt end of Cheapſide.—In this lane alſo is St Martin's le Grand, which, though ſurrounded by the city, was yet ſubject, near three centuries, to Weſtminſter-Abbey. A fine college was built here in 700 by Wythred king of Kent; and, about the year 1056, rebuilt and chiefly endowed by Ingelric and Edward, two noble brothers. In 1068, it was confirmed and made independent of every other eccleſiaſtical juriſdiction, even that of the pope himſelf not excepted; and its privileges were confirmed by ſucceeding monarchs. It was governed by a dean, and a number of ſecular canons. In this juriſdiction a magnificent church was erected, but pulled down in 1548, when the college was ſurrendered; after which a tavern was erected on the ſpot.

72 The Croſs and Conduit.

A little to the weſtward of Mary-le-Bow church (in the adjoining ward), ſtood the *Croſs* and *Conduit* in the middle of the ſtreet. The former was built by Edward I. in 1290, in memory of his queen Eleanor, whoſe body was reſted on that ſpot in its way to be buried. Originally it had the ſtatue of the queen at full length, reſembling exactly that at Northampton. Having at length fallen to decay, it was rebuilt in 1441 by John Hutherby mayor of the city, at the expence of ſeveral citizens, being now ornamented with various images, as thoſe of the Reſurrection, the Virgin Mary, &c. As the magnificent proceſſions took this road, it was new-gilt at every public entry. After the Reformation, the images gave ſo much offence, that it was thought proper to ſubſtitute that of Diana in place of the Virgin Mary. This, however, was reſented by Queen Elizabeth, who offered a reward for the diſcovery of the offenders. As ſhe imagined that a croſs, the ſymbol of the Chriſtian religion, could not juſtly give offence to any profeſſor of that religion, ſhe ordered a croſs to be placed on the ſummit, and gilt; but in 1643, the parliament ordered the demolition of all croſſes and other marks of Romiſh ſuperſtition.

Splendid tournaments were held between the Croſs and Sopers-lane in the year 1331; but as Queen Philippa and a great number of other ladies, dreſſed in rich attire, were ſitting on the upper ſcaffolding to behold the ſports, the ſeats gave way, and they ſuddenly fell down among the knights and others who ſtood below; many of whom were grevouſly hurt. The carpenters were ſaved from puniſhment by the interceſſion of the queen; but the king, to prevent accidents of the like nature, ordered a building of ſtone to be erected near Bow-church, from whence the queen and other ladies might behold ſuch ſpectacles in ſafety. This was uſed for the ſame purpoſe till the year 1410, when Henry IV. granted it to certain mercers, who converted it into ſhops, warehouſes, and other places neceſſary for their trade.

A ſmall diſtance eaſtward from the Croſs ſtood the Conduit, which ſerved to fill the leſſer ones with water brought by pipes from Paddington.—This ſtood on the ſpot where the old conduit was ſituated, which was founded in 1285, conſtructed of ſtone lined with lead, and rebuilt in 1479 by Thomas Ilan one of the ſheriffs. On ſome grand occaſions, theſe conduits have been made to run with claret; as at the coronation of Anna Bullen.

73 Mercers Hall.

On the north ſide of Cheapſide ſtood the *Hoſpital of St Thomas of Acon,* founded by Fitz-Theobald de Helles, and his wife Agnes, ſiſter to the famous Thomas a Becket. The hoſpital was built 20 years after the murder of Thomas; and ſuch was his reputation

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for ſanctity, that it was dedicated to him even before he was canonized, and that in conjunction with the Virgin Mary herſelf. The whole was granted by king Henry VIII. to the company of mercers. It was deſtroyed by the great fire in 1666; but rebuilt by the mercers company, who have their hall here.—

74 Old Jewry. Immediately to the eaſt is a narrow ſtreet called the *Old Jewry*, which took its name from a great ſynagogue which ſtood here till the Jews were expelled the kingdom in 1291. After them an order of friars named *Fratres de ſacca*, or *de penitentia*, took poſſeſſion of the ſynagogue, and in 1305, Robert Fitzwalter, the great banner-bearer of the city, requeſted that the friars might aſſign it to him; the reaſon of which probably was, that it ſtood near to his houſe, which was ſituated in the neighbourhood of the preſent Grocers-hall. The chapel was bought by the grocers from Fitzwalter in 1411 for 320 marks.

75 Bakewell Hall. In Baſſiſhaw or Baſing-hall ward, is *Blackwell* or *Bakewell hall*, which adjoins to Guildhall, and is the greateſt mart of woollen cloth in the world. It was purchaſed of King Richard II. by the city; and has ever ſince been uſed as a weekly market for broad and narrow woollen cloths, brought out of the country. Formerly proclamations were iſſued to compel people to bring their goods into the hall, to prevent deceit in the manufactures, which might be productive of diſcredit in foreign markets, and likewiſe be the means of defrauding poor children of Chriſt's hoſpital of part of the revenue which aroſe from the hallage of this great magazine. It ſuffered in the general devaſtation in 1666; but was rebuilt in 1672, and is now a ſpacious edifice, with a ſtone front adorned with columns.

76 Sion College. Cripplegate-ward is remarkable for a college, called *Sion-college*, founded in 1627, on the ſite of Elſing-hoſpital (D) or priory, by Dr Thomas White vicar of St Dunſtan's in the Weſt, for the improvement of the London clergy; and with alms-houſes, under their care, for 20 poor perſons, 10 men and 10 women. In the year 1631, a charter was procured for incorporating the clergy of London, by which they were conſtituted fellows of the college; and out of the incumbents are annually elected, on Tueſday three weeks after Eaſter, a preſident, two deans, and four aſſiſtants, who are to meet quarterly, to hear a Latin ſermon, and afterwards be entertained at dinner in the college-hall at the expence of the foundation. John Simpſon rector of St Olaves, who ſuperintended the building, added, at his own expence, for the uſe of the ſtudious part of the London clergy, a library 120 feet long, and amply filled with books.

77 Barbers Hall. In this ward is a hall which belonged to the company of barber-ſurgeons, the profeſſions of barber and ſurgeon being formerly exerciſed by the ſame perſon. It was built by the celebrated Inigo Jones, and the upper end is formed out of one of the towers or barbicans of London wall. The anatomical theatre is elliptical, and very finely contrived. This hall is now called *Barbers Hall*; the ſurgeons, who diſdained to be any longer aſſociated with their ancient brethren, having obtained a ſeparate charter, and built themſelves a new hall in the old Bailey.

78 St Paul's Cathedral. Farringdon-ward Within, is diſtinguiſhed by the moſt magnificent Proteſtant church in the world, the cathedral of *St Paul*. The beſt authority we have for the origin of this church, is from its great reſtorer Sir Chriſtopher Wren. His opinion that there had been a church on this ſpot, built by the chriſtians in the time of the Romans, was confirmed: when he ſearched for the foundations for his own deſign, he met with thoſe of the original *preſbyterium*, or ſemicircular chancel, of the old church. They conſiſted only of Kentiſh-rubble-ſtone, artfully worked, and conſolidated with exceedingly hard mortar, in the Roman manner, much excelling the ſuperſtructure. He explodes the notion of there having been here a temple of Diana, and the diſcovery of the horns of animals uſed in the ſacrifices to that goddeſs, on which the opinion had been founded, no ſuch having been diſcovered in all his ſearches.

The firſt church is ſuppoſed to have been deſtroyed in the Diocleſian perſecution, and to have been rebuilt in the reign of Conſtantine. This was again demoliſhed by the pagan Saxons; and reſtored, in 603, by Sebert, a petty prince, ruling in theſe parts, under Ethelbert king of Kent, the firſt Chriſtian monarch of the Saxon race; who, at the inſtance of St Auguſtine, appointed Melitus the firſt biſhop of London. Erkenwald, the ſon of king Offa, fourth in ſucceſſion from Melitus, ornamented his cathedral very highly, and improved the revenues with his own patrimony. He was moſt deſervedly canonized: for the very litter, in which he was carried in his laſt illneſs, continued many centuries to cure fevers by the touch; and the very chips, carried to the ſick reſtored them to health!

When the city of London was deſtroyed by fire, in 1086, this church was built; the biſhop Mauritius began to rebuild it, and laid the foundations, which remained till its ſecond deſtruction, from the ſame cauſe, in the laſt century. Notwithſtanding Mauritius lived twenty years after he had begun this pious work, and biſhop Beauvages enjoyed the ſee twenty more, yet ſuch was the grandeur of the deſign, that it remained unfiniſhed. The firſt had the ruins of the Palatine Tower beſtowed on him, as materials for the building; and Henry I. beſtowed on Beauvages part of the ditch belonging to the Tower, which, with purchaſes made by himſelf, enabled him to incloſe the whole with a wall. The ſame monarch granted beſides, that every ſhip which brought ſtone for the church, ſhould be exempted from toll; he gave him alſo the great fiſh taken in his precincts, except the tongues; and, laſtly, he ſecured to him and his ſucceſſor the delicious tythes of all his veniſon in the county of Eſſex.

The ſtyle of the ancient cathedral was a moſt beautiful Gothic; over the eaſt end was an elegant circular window; alterations were made in the ends of

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(D) This was founded by William Elſing mercer in 1329 (on the ſite of a decayed nunnery), for the ſupport of 100 blind men. He afterwards changed it into a priory, and became himſelf the firſt prior, who with four canons-regular were to ſuperintend the miſerable objects.

the two tranſepts, ſo that their form is not delivered down to us in the ancient plans; and from the central tower roſe a lofty and moſt graceful ſpire. The dimenſions, as taken in 1309, were theſe: The length ſix hundred and ninety feet; the breadth a hundred and twenty; the height of the roof of the weſt part, from the floor, one hundred and two; of the eaſt part, a hundred and eighty-eight; of the tower, two hundred and ſixty; of the ſpire, which was made of wood covered with lead, two hundred and ſeventy-four. The whole ſpace the church occupied was three acres and a half, one rood and a half, and ſix perches.

We may be aſtoniſhed at the amazing building, and naturally inquire what fund could ſupply money to ſupport ſo vaſt an expence. But monarchs reſigned their revenues reſulting from the cuſtoms due for the materials, which were brought to the adjacent wharfs; they furniſhed wood from the royal foreſts: prelates gave up much of their revenues; and, what was more than all, the pious bait of indulgences, and remiſſions of penance, brought in from the good people of the realm moſt amazing ſums. Pope Innocent III. in 1252, gave a releaſe of ſixty days penance; the archbiſhop of Cologne gave, a few years before, a relaxation of fifty days; and Boniface, archbiſhop of Canterbury, forty days.

The high altar dazzled with gems and gold, the gifts of its numerous votaries. John King of France, when priſoner in England, firſt paying his reſpects to St Erkenwald's ſhrine, offered four baſons of gold: and the gifts at the obſequies of princes, foreign and Britiſh, were of immenſe value. On the day of the converſion of the tutelar ſaint, the charities were prodigious, firſt to the ſouls, when an indulgence of forty days pardon was given, *vere pœnitentibus, contritis et confeſſis*; and, by order of Henry III. fifteen hundred tapers were placed in the church, and fifteen thouſand poor people fed in the churchyard.

The holineſs of this place did not prevent thieves and profligates of all denominations, from lurking within the precincts, and committing, under the favour of the night, murders and every ſort of crimes. Edward gave the dean and canons permiſſion to incloſe the whole within a wall; and to have gates to be ſhut every night, to exclude all diſorderly people. Within theſe walls, on the north-weſt ſide, was the biſhop's palace. Froiſſart tells us, that after the great tournament in Smithfield, king Edward III. and his queen lodged here, on occaſion of their nuptials (E)—In 1561, the noble ſpire was totally burnt by lightning, and never reſtored.

In conſequence of the reſolutions taken in 1620, by James I. to repair the cathedral, the celebrated Inigo Jones was appointed to the work. But it was not attempted till the year 1633, when Laud laid the firſt ſtone, and Inigo the fourth. That great architect begun with a moſt notorious impropriety, giving to the weſt end a portico of the Corinthian order, beautiful indeed, to this ancient gothic pile; and to the ends of the two tranſepts, gothic fronts in a moſt horrible ſtyle. The great fire made way for the reſtoring of this magnificent pile in its preſent noble form by Sir Chriſtopher Wren, an architect worthy of ſo great a deſign.

It is built of fine Portland ſtone, in form of a croſs. On the outſide are two ranges of pilaſters, conſiſting of an hundred and twenty each; the lower range of the Corinthian order, and the upper of the compoſite. The ſpaces between the arches of the windows and the architrave of the lower order, are filled with a great variety of curious enrichments, as are alſo thoſe above. On the north ſide is a portico, the aſcent to which is by twelve ſteps of black marble, and its dome ſupported by ſix very large columns. Over the dome is a pediment, the face of which is engraved with the royal arms, regalia, and other ornaments. On the ſouth is a portico, the aſcent to which is by twenty five ſteps, and its dome ſupported by ſix columns, correſponding with thoſe on the north ſide. The weſt front is graced with a moſt magnificent portico, ſupported by twelve lofty Corinthian columns: over theſe are eight columns of the compoſite order, which ſupport a noble pediment, crowned with its acroteria, and in this pediment is the hiſtory of St Paul's converſion, boldly carved in bas relief. The aſcent to this portico

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(E) Before this cathedral was the famous *Paul's Croſs*, a pulpit formed of wood, mounted upon ſteps of ſtone, and covered with lead, in which the moſt eminent divines were appointed to preach every Sunday in the forenoon. To this place, the court, the mayor, and aldermen, and principal citizens, uſed to reſort. The greateſt part of the congregation ſat in the open air; the king and his train had covered galleries; and the better ſort of people were alſo protected from the injury of the weather; but the far greater part ſtood expoſed in the open air: for which reaſon the preacher went in very bad weather to a place called the Shrouds; a covered ſpace on the ſide of the church, to protect the congregation in inclement ſeaſons. Conſiderable contributions were raiſed among the nobility and citizens, to ſupport ſuch preachers as were (as was often the caſe) called to town from either of the univerſities. In particular, the lord mayor and aldermen ordered that every preacher, who came from a diſtance, ſhould be freely accommodated, during five days, with ſweet and convenient lodgings, fire, candle, and all neceſſaries. And notice was given by the biſhop of London, to the preacher appointed by him, of the place he was to repair to.

We hear of this being in uſe as early as the year 1259. It was uſed, as Mr Pennant obſerves, not only for the inſtruction of mankind by the doctrine of the preacher, but for every purpoſe political or eccleſiaſtical; for giving force to oaths, for promulging of laws, or rather the royal pleaſure, for the emiſſion of papal bulls, for anathematizing ſinners, for benedictions, for expoſing of penitents under cenſure of the church, for recantations, for the private ends of the ambitious, and for the defaming of thoſe who had incurred the diſpleaſure of crowned heads.

It was demoliſhed in 1643 by order of parliament, executed by the willing hands of Iſaac Pennington, the fanatical lord mayor of that year, who died in the tower a convicted regicide.

is by a flight of ſteps of black marble, extending the whole length of the portico; and over each corner of the weſt front is a beautiful turret. A vaſt dome, or cupola, riſes in the centre of the building. Twenty feet above the roof of the church is a circular range of thirty-two columns with niches, placed exactly againſt others within. Theſe are terminated by their entablature, which ſupports a handſome gallery, adorned with a ſtone balluſtrade. Above the columns laſt mentioned is a range of pilaſters, with windows between them: and from the entablature of theſe, the diameter of the dome gradually decreaſes. On the ſummit of the dome is an elegant balcony, from the centre of which runs a beautiful lanthorn, adorned with Corinthian columns. The whole is crowned with a copper ball, ſupporting a croſs, both finely gilt. Within, the cupola ſtands on eight ſtupendous pillars, curiouſly adorned: the roof of the choir is ſupported by ſix pillars, and that of the church by two ranges, conſiſting of twenty more. The roof of the church and choir is adorned with arches and ſpacious peripheries of enrichments, admirably carved in ſtone. Quite round the inſide of the cupola, there is a whiſpering iron balcony, or gallery, the top of which is richly painted by Sir James Thornhill.

The firſt ſtone of this ſuperb edifice was laid on June 21, 1675; and the building was completed in 1710; but the whole decorations were not finiſhed till 1723. It was a moſt ſingular circumſtance, that, notwithſtanding it was 35 years in building, it was begun and finiſhed by one architect, and under one prelate Henry Compton biſhop of London. The church of St Peter's was 195 years in building, in the reigns of 19 popes, and went through the hands of twelve architects. It is not, as often miſtaken, built after the model of that famous temple: it is the entire conception of our great countryman, and has been preferred in ſome reſpects, by a judicious writer, to even the Roman Baſilica. Its dimenſions are leſs. The comparative view is given in the Parentalia, and copied in London and its environs. The height of St Peter's, to the top of the croſs, is 437 feet and an half; that of St Paul's 340 feet; ſo that, from its ſituation, it is lofty enough to be ſeen from the ſea. The length of the firſt is 729 feet; of the latter, 500. The greateſt breadth of St Peter's is 364; of St Paul's, 180.

In the reigns of James I. and Charles I. the body of this cathedral was the common reſort of the politicians, the news mongers, and idle in general. It was called *Paul's walk;* and is mentioned in the old plays and other books of the times.

Notwithſtanding the magnificence of this noble pile, however, it is remarked to have many defects. Its ſituation is ſuch, that it cannot be viewed at a diſtance. The diviſion of the porticos, and the whole ſtructure into two ſtories on the outſide, certainly indicate a like diviſion within, which is acknowledged to be a fault. The dome, it has alſo been obſerved, bears too great a proportion to the reſt of the pile, and ought to have been raiſed exactly in the centre of the building; beſides that, there ought to have been two ſteeples at the eaſt end, to correſpond with thoſe at the weſt. On entering this church, we inſtantly perceive an obvious deficiency, not only of elevation but length, to aſſiſt the perſpective; and the columns are heavy and clumſy, rather incumbering the proſpect than enriching it.

St Paul's occupies an area of ſix acres, and is railed all round with iron baluſtrades, each about five feet and an half high, fixed on a dwarf wall of hewn ſtone. In the weſt end of this area is a marble ſtatue of Queen Anne, holding a ſceptre in one hand, and a globe in the other, ſurrounded with four emblematical figures, repreſenting Great Britain, France, Ireland, and America.

Beſides very large contributions for carrying on this edifice, the parliament granted a duty on ſea coal, which, at a medium, produced 5000 l. a-year; and the whole expence of the building is ſaid to have amounted to 736,752 l. 2 s. 3 d.

On the eaſt ſide of the cathedral is *St Paul's School*, founded in 1509 by Dr John Collet dean of this church who endowed it for a principal-maſter, an under-maſter, a chaplain, and 153 ſcholars.

79 **College of Phyſicians.** In Warwick-lane, in the ſame ward, ſtands the *College of Phyſicians*, erected in 1682 by Sir Chriſtopher Wren. It is built of brick, and has a ſpacious ſtone frontiſpiece. Near the ſouth extremity of the Old Bailey, on the eaſt ſide, is the hall of the Company of Surgeons, with a theatre for diſſection.

80 **Chriſt's Hoſpital.** Adjoining to Chriſt-church in Newgate-ſtreet is *Chriſt's-Hoſpital*, which, before the diſſolution of monaſteries by Henry VIII. was a houſe of grey-friars. The hoſpital was founded by King Edward VI. for ſupporting and educating the fatherleſs children of poor freemen of this city; of whom 1000 of both ſexes are generally maintained in the houſe or out at nurſe, and are likewiſe cloathed and educated. In 1673, a mathematical ſchool was founded here by Charles II. endowed with L.320 a-year; and a writing-ſchool was added in 1694 by Sir John Moor, an alderman of the city. After the boys have been ſeven or eight years on the foundation, ſome are ſent to the univerſity and others to ſea; while the reſt, at a proper age, are put apprentices to trades at the charge of the hoſpital. At firſt their habit was a ruſſet cotton, but was ſoon after changed for blue, which has ever ſince continued to be their colour; and on this account the foundation is frequently called the *blue-coat hoſpital*. The affairs of this charity are managed by a preſident and about 300 governors, beſides the lord-mayor and aldermen. The fabric, which is partly Gothic and partly modern, was much damaged by the fire of 1666, but was ſoon repaired, and has been ſince increaſed with ſeveral additions. The principal buildings, which form the four ſides of an area, have a piazza round them with Gothic arches, and the walls are ſupported by abutements. The front is more modern, and has Doric pilaſters ſupported on pedeſtals.

81 **Doctor's Commons.** In Caſtle-Baynard ward is a large ſtructure called *Doctors-Commons*. It conſiſts of ſeveral handſome paved courts, in which the judges of the court of admiralty, thoſe of the court of delegates, of the court of arches, and the prerogative court, with the doctors that plead cauſes, and the proctors of the place, all live in a collegiate way; and from commoning together, as in other colleges, the name of Doctors-Commons is derived. Here courts are kept for the trial of civil and eccleſiaſtical cauſes under the archbiſhop of Canterbury

and the biſhop of London. The college has an excellent library, every biſhop at his conſecration giving L. 20 or L. 50 towards purchaſing books for it.

82 **College of Heralds.** Near Doctors-Commons, on St Bennet's Hill, is the *College of Heralds*, who were incorporated by King Richard III. Beſides the chief officer, who is the earl-marſhal of England, here are three kings at arms, *viz.* Garter, Clarencieux, and Norroy, with ſix heralds, four purſuivants, and eight proctors. Garter attends the inſtalments of knights of that order, carries the garter to foreign princes, regulates the ceremonies at coronations, and the funeral of the royal family and nobility: Clarencieux directs the funeral ceremonies of thoſe under the degree of peers ſouth of Trent; and Norroy performs the like office for thoſe north of Trent. This building was originally the houſe of the earl of Derby. It is a ſpacious quadrangle, built of brick and has convenient apartments. Here are kept records of the coats of arms of all the families and names in England, with an account when they were granted, and on what occaſion.

83 **Bridewell.** In Farringdon-ward Without is a large building called *Bridewell,* from a ſpring formerly known by the name of St Bridget's or St Bride's-Well. It was originally a royal palace, and occupied all the ground from Fleet-ditch on the eaſt to Water-lane on the weſt. That part of it now called *Saliſbury-court* was given to the biſhops of Saliſbury for their town reſidence; and the eaſt part, which was rebuilt by King Henry VIII. is the preſent Bridewell. It was granted to the city by Edward VI. as an hoſpital; and he endowed it for the lodging of poor travellers, and for the correction of vagabonds, ſtrumpets, and idle perſons, as well as for finding them work. In one part of the building 20 artificers have houſes; and about 150 boys, diſtinguiſhed by white hats and blue doublets, are put apprentices to glovers, flax-dreſſers, weavers, &c. and when they have ſerved their time are intitled to the freedom of the city, with L. 10 towards carrying on their reſpective trades. The other part of Bridewell is a receptacle for diſorderly perſons, who are kept at beating hemp and other hard labour.

Near Bridewell is *St Bridge's Church*; a ſtately fabric 111 feet long, 57 broad, and 41 high, with a beautiful ſpire 234 feet in altitude, and has a ring of 12 bells in its tower.

84 **Blackfriars Bridge.** Oppoſite to Fleet-ditch, over this part of the river, ſtands *Blackfriars Bridge;* a moſt elegant ſtructure built after the deſign of Mr Robert Mylne. The ſituation of the ground on the two ſhores obliged the architect to employ elliptical arches; which, however, have a very fine effect. The number of arches is nine; of which the centre one is 100 feet wide. The whole length is 995 feet: the breadth of the carriage-way is 28 feet, and that of the two foot-ways 7 each. Over each pier is a receſs; an apology for the beautiful Ionic pillars which ſupport them, and which have a moſt beautiful effect from the river. This bridge was begun in 1760; and finiſhed in 1768, at the expence of L. 152,840, to be diſcharged by a toll upon the paſſengers. It is ſituated almoſt at an equal diſtance between thoſe of Weſtminſter and London, commands a view of the Thames from the latter to Whitehall, and diſcovers the majeſty of St Paul's in a very ſtriking manner.

85 **Smithfield.** *Weſt Smithfield.* In this ward is an area containing three acres of ground, called in old records *Smithfield-Pond* or *Horſe-Pool,* it having been formerly a watering place for horſes. It was in ancient times the common place of execution; and at the ſouth-weſt corner there was a gallows called the *Elms,* from a number of elm-trees that grew in the neighbourhood. It was likewiſe the ſcene of public juſts and tournaments, and has been a market-place for cattle above 500 years.

86 **St Bartholomew's Hoſpital.** On the ſouth-ſide of this area, and contiguous to Chriſt's hoſpital, is *St Bartholomew's Hoſpital.* It was originally founded ſoon after the acceſſion of Henry I. by Rahere the king's jeſter, was an infirmary for the priory of St Bartholomew the Great, which then ſtood near the ſpot. But upon the diſſolution of religious houſes, Henry VIII. refounded it, and endowed it with 500 merks a year, on condition that the citizens ſhould pay the ſame ſum annually for the relief of 100 lame and infirm patients. The endowments of this charity have ſince been ſo much enlarged, that it now receives the diſtreſſed of all denominations. In 1702, a beautiful frontiſpiece was erected towards Smithfield adorned with pilaſters, entablature, and a pediment of the Ionic order, with a ſtatue of King Henry VIII. ſtanding in a niche in full proportion, and thoſe of two cripples on the top of the pediment over it. In 1729, a plan was formed for rebuilding the reſt of this hoſpital, in conſequence of which a magnificent edifice has been erected.

Among many other privileges granted by Henry I. to the prior and canons of the monaſtery of St Bartholomew the Great, and to the poor of the infirmary, was that of keeping a fair in Smithfield on the eve, day, and morrow, of St Bartholomew. This fair, called *Bartholomew-fair,* has been held annually ever ſince; and by the indulgence of the magiſtrates of London, to whom the privilege of keeping it devolved upon the diſſolution of the priory, it uſed to continue a fortnight. A great number of booths were erected in it by the actors of the theatres, for the exhibition of dramatic performances of various kinds; and it became at length a ſcene of ſo much licentiouſneſs and riot that Sir John Barnard when lord-mayor of London reduced the time of the fair to its original duration of three days. This laudable example has been followed ever ſince; and the magiſtrates have likewiſe prohibited all public exhibitions which had been formerly accompanied with ſo much diſorder.

87 **Old Bailey.** In a ſtreet in this ward, called the *Old Baily,* is a hall named *Juſtice-hall,* or the *Seſſion's-houſe,* where a court is held eight times a year by the king's commiſſion of oyer and terminer for the trial of criminals for offences commited within the city of London and county of Middleſex. The judges of this court are the lord-mayor, thoſe of the aldermen that have ſerved that office, and the recorder, who are attended by the ſheriffs and by one or more of the national judges.

88 **Newgate.** In this ſtreet is alſo the great criminal priſon, lately built in a much more convenient ſituation, and on a more enlarged plan than the former priſon, called *Newgate;* by which name it is ſtill diſtinguiſhed. Here the unfortunate debtor will no longer be annoyed by the dreadful rattle of chains, or by the more horrid ſounds iſſuing from the lips of thoſe wretched beings who ſet defiance to all laws divine and human; and

and here alſo the offender, whoſe crime is not capital may enjoy all the benefits of a free open air.

89 Fleet-priſon. In this ward is likewiſe a priſon called the *Fleet-priſon*, from a ſmall river named the Fleet which formerly run by it: this building is large, and reckoned the beſt in the city for good rooms and other conveniences. It has the benefit of a large yard which is encloſed with a very high, wall. This priſon is as ancient as the reign of Richard I. and belongs to the court of chancery, &c.

90 The Rolls. In Chancery-lane, in this ward, is an office conſiſting of a houſe and chapel, called the office and chapel of the *Rolls*, from being the great repoſitory of the modern public rolls and records of the kingdom. This building was originally the houſe of an eminent Jew; but being forfeited to the Crown, King Henry III. in the year 1223 converted it into an hoſpital for the reception and accommodation of Jewiſh and other proſelytes. In 1377, Edward III. granted this hoſpital and its chapel to William Burſtall maſter of the rolls, to whoſe ſucceſſors in that office it has ever ſince belonged. Round this office there is a ſmall diſtrict coſiſting of about 200 houſes, called the *Liberty of the Rolls*, over which the magiſtrates of London have no authority, it being under the government of the maſter of the rolls.

In this ward are ſeveral *Inns* of court and chancery, particularly the inner and Middle-Temple, Serjeant's Inn, Clifford's-Inn, Barnards's-Inn, Staples-Inn, and Furnival's-Inn.

91 The Temple. The *Temple* received its name from being originally founded by the Knight's-Templars, who ſettled here in 1185. It was at firſt called the *New Temple*, to diſtinguiſh it from the former houſe of the Knight's Templars, which ſtood in Holborn near Chancery-lane.

The original building was divided into three parts the Inner, the Middle, and the Outer Temple. The Inner and the Outer Temple were ſo called, becauſe one was within and the other was without the Bar; and the Middle derived its name from being ſituated between them. Upon the diſſolution of the order of Knights-Templars, the New Temple devolved to the Knights-Hoſpitallers of St John of Jeruſalem, who granted a leaſe of it to the ſtudents of the common law, and converted that part of it called Inner and Middle Temple into two inns of court for the ſtudy and practice of the common law. The Outer Temple became a houſe for the earl of Eſſex.

The buildings of the Temple eſcaped the fire in 1666, but were moſt of them deſtroyed by ſubſequent fires, and have ſince been rebuilt. The two Temples are each divided into ſeveral courts, and have pleaſant gardens on the banks of the Thames. They are appropriated to diſtinct ſocieties and have ſeparate halls, where the members dine in common during term-time. The Inner-Temple hall is ſaid to have been built in the reign of Edward III. and the Middle-Temple hall which is a magnificent edifice, was rebuilt in 1572 in form of a college hall. The Middle-Temple gate, Mr Pennant informs us, was erected by Sir Amias Powlet on a ſingular occaſion. It ſeems that Sir Amias, about the year 1501, thought fit to put Cardinal Wolſey, then parſon of Lymington, into the ſtocks. In 1515, being ſent for to London by the cardinal on account of that ancient grudge, he was commanded not to quit town till farther orders. In conſequence, he lodged five or ſix years in this gateway, which he rebuilt; and to pacify his eminence, adorned the front with the cardinal's cap, badges, cogniſance, and other devices of this butcher's ſon: ſo low were the great men obliged to ſtoop to that meteor of the times! Each temple has a good library, adorned with paintings and well furniſhed with books. An aſſembly, called a *parliament*, in which the affairs of the ſociety of the Inner-Temple are managed, is held there every term. Both temples have one church, firſt founded in 1185 by the Knights-Templers; but the preſent edifice is ſuppoſed to have been built in 1420. It is ſupported by neat ſlender pillars of Suſſex marble, and is one of the moſt beautiful Gothic ſtructures in England. In this church are many monuments, particularly of nine Knights-Templars cut in marble in full proportion, ſome of them ſeven feet and a half long: ſix are croſs-legged, and therefore ſuppoſed to have been engaged in the cruſades. The miniſter of this church, who is uſually called the *Maſter of the Temple* is appointed by the benchers or ſenior members of both ſocieties, and preſented by a patent from the crown. Shakeſpeare (whether from tradition or hiſtory) makes the temple garden the place in which the badge of the white and red roſe originated; the diſtinctive badge of the houſes of York and Lancaſter, under which the reſpective partizans of each arranged themſelves in the fatal quarrel which cauſed ſuch torrents of Engliſh blood to flow.

Near Temple-bar is the *Devil tavern*, ſo called from its ſign of St Dunſtan ſeizing the evil ſpirit by the noſe with a pair of hot tongs. Ben Jonſon has immortalized it by his *Leges Conviviales*, which he wrote for the regulation of a club of wits held here in a room he dedicated to Apollo; over the chimney-piece of which they are preſerved. The tavern was in his days kept by Simon Wadloe; whom in a copy of verſes over the door of the Apollo, he dignified with the title of *King of Skinkers*.

92 Inns of Chancery. *Serjeant's Inn* is a ſmall inn in Chancery-lane, where the judges and ſerjeants have chambers, but not houſes, as they had in another inn of this name in Fleet-ſtreet, which they abandoned in 1730; but in each of them there is a hall and a chapel. *Clifford's Inn* is an inn of chancery belonging to the Inner temple. It was originally a houſe granted by Edward II. to the family of the Cliffords, from which it derived its name; but was afterwards let upon leaſe to the ſtudents of the law, and in the reign of Edward III. ſold to the members of this ſociety. *Bernard's Inn* is likewiſe an inn of Chancery belonging to Gray's-Inn. It ſtands in Holborn, and was the houſe of John Mackworth dean of Lincoln, who gave it to the profeſſors of the law. *Staple's Inn* belongs alſo to Gray's Inn, and is ſituated in Holborn. It was once a hall for the merchants of the ſtaple for wool, whence it derives its name; but it was purchaſed by the benchers of Gray's-Inn, and has been an inn of chancery ſince the year 1415. *Furnival's Inn* is an inn of chancery belonging to Lincoln's-Inn, and was once the houſe of the family of the Furnivals, by whom it was let out to the profeſſors of the law. It is a large old building with a hall and a pleaſant garden.

93 Bethlehem Hoſpital. In Colman-ſtreet ward on the ſouth ſide of a large ſquare called *Moorfields*, ſtands *Bethlehem-hoſpital*, founded in 1675 by the lord-mayor and citizens of London for the reception and cure of poor lunatics. It is a noble edifice, built with brick and ſtone, and adorned with pilaſters, entablatures, and ſculpture; particularly with the figures of two lunatics over the grand gate, which are well executed. This building is 540 feet long and 40 broad, excluſive of two wings of a later erection, intended for the reception of ſuch lunatics as are deemed incurable. This hoſpital contains a great number of convenient cells or apartments where the patients are maintained and receive all medical aſſiſtance without any other expence to their friends than that of bedding. The ſtructure is divided into two ſtories, through each of which runs a long gallery from one end of the houſe to the other. On the ſouth ſide are the cells, on the north the windows that give light to the galleries, which are divided in the middle by handſome iron gates, to keep the men and women ſeparate. This hoſpital being united to that of Bridewell, both are managed by the ſame preſident, governors, treaſurer, clerk, phyſician, ſurgeon, and apothecary; but each has a ſteward and inferior officers peculiar to itſelf.

94 St Luke's Hoſpital. Oppoſite to Bethlehem-hoſpital ſtood that of *St Luke*, a long plain building, till of late appropriated to the ſame purpoſes, but wholly independent of the former. It was founded on the humane conſideration that Bethlehem was incapable of receiving all the miſerable objects which were offered. Of late years the patients were removed from the old hoſpital to a new one erected under the ſame name in Old-ſtreet, on the plan of the former, extending in front 393 feet. The old hoſpital is now pulled down, and replaced by a handſome row of houſes. Uncured patients may be taken in again, by a very liberal regulation, on the payment of five ſhillings a week; ſo that their friends may if they chooſe, try a ſecond time the force of medicine on their unhappy relations or acquaintances.

95 Different Markets. Beſides the three markets already mentioned at Smithfield for cattle and hay, at Leadenhall for butcher's meat, wool, hides, and Colcheſter baize, and at Billingſgate for fiſh; there are in this city the following other markets, which are all very conſiderable, *viz.* Honey-lane, Newgate, and Fleet-market, chiefly for fleſh, though with ſeparate diviſions for fiſh, butter, eggs, poultry, herbs, and fruit; and the Three-Cranes market, for apples and other fruit. The principal corn-market is held in a neat exchange ſituated in Mark-lane, and that for flour at Queenhithe. In Thames-ſtreet, near Billingſgate, there is an exchange for dealers in coals and maſters of veſſels in that trade to tranſact their buſineſs.

96 2. Borough of Southwark, its juriſdiction &c. II. *The Borough of* SOUTHWARK. It was called by the Saxons *Suth*, or the "South work," in reſpect to ſome fort or fortification bearing that aſpect from London. It was alſo called the Borough, or *Burg*, probably from the ſame reaſon. It was long independent of the city of London: but in conſideration of the inconveniences ariſing from the eſcape of malefactors from the great capital into this place, it was in 1327 granted by Edward III. to the city on payment of L. 10 annually. It was then called the *village* of Southwark; it was afterwards ſtyled the *bailiwick* of Southwark, and the mayor and commonality of London appointed the bailiff. This power, however, not being ſufficient to remedy the evil, a more intimate connection was thought neceſſary; and in the reign of Edward VI. on a valuable conſideration paid to the crown, it was formed into a 26th ward, by the title of *Bridge-Ward Without*; with a reſervation of certain privileges enjoyed there by the archbiſhop of Canterbury and ſome other eccleſiaſtics. In conſequence of this, it was ſubjected to the lord-mayor of London, with the ſteward and bailiff. But Southwark being divided into two parts, this is to be underſtood of the diviſion called the *Borough Liberty*, which conſiſts of three of the pariſhes belonging to the town, with the greater part of a fourth pariſh. For the city diviſion, the lord-mayor by his ſteward holds a court of record every Monday at the ſeſſions-houſe on St Margaret's Hill in this borough for all debts, damages, and treſpaſſes, within the limits of his juriſdiction.—The other diviſion is called the *Clink*, or the *Manor of Southwark*, and is ſubdivided into the Great Liberty, the Guildhall, and the King's Manor: for each of which ſubdiviſions a court-leet is held, where the conſtables, aleconners, and fleſh-taſters, are choſen, and other buſineſs of this kind tranſacted. 97 Courts. A court-houſe, called *Union-Hall*, has lately been built in the new ſtreet called *Union-ſtreet*, which leads in a direct line from the high-ſtreet in the Borough to Great Surry-ſtreet Blackfriars-road. The Clink liberty is under the juriſdiction of the biſhop of Wincheſter, who, beſides a court-leet, keeps here a court of record on the Bankſide near St Saviour's church by his ſteward or bailiff, for pleas of debt, damages, and treſpaſſes. Court-leets are alſo kept at Lambeth, Bermondſey, and Rotherhithe, three ſmall diſtricts adjoining to the Borough 98 Priſons. —There is a counter for the impriſonment of offenders in the bailiwick and another for the Clink liberty; to which may be added the Surry workhouſe for vagrants. Beſides, theſe, there is the marſhalſea-priſon which is the county-gaol for felons, and the admiralty-gaol for pirates (G); in which is a court firſt erected for trials of cauſes between the king's domeſtics or menial ſervants, of which the knight marſhal is preſident, and his ſteward judge, to whom belong four counſellors and ſix attorneys; and the court is held every Friday by him or his deputy, for debt, damages, and treſpaſſes in cauſes for 10 miles round Whitehall, excepting London.—In this quarter is alſo the king's-bench priſon, the rules of which are above two miles in circuit, and compriſe the greateſt part of St George's Fields. Here was committed Henry prince of Wales, afterwards King Henry V. by the ſpirited and honeſt judge Gaſcoigne, for ſtriking or inſulting him on the bench.

(G) In 1377 this priſon was broke open by a mob of ſailors, who murdered a gentleman confined in it for killing one of their comrades, and who had been pardoned by the court. It was again broke open by Wat Tyler and his followers in 1381. It eſcaped in the infamous riots of 1780; while the King's Bench, the Borough-priſon, and the Clink-priſon, were nearly at the ſame inſtant ſacrificed to their fury.

bench. In this priſon the allowance is ſomewhat better than that of the common priſons; for which reaſon, many debtors remove themſelves hither by *habeas corpus.* It is properly a place of confinement in all caſes triable in the King's-bench court.—The firſt time that Southwark is mentioned in hiſtory is on occaſion of Earl Goodwin's ſailing up the river to attack the royal navy of 50 ſhips lying before the palace of Weſtminſter; this was in 1052, when we are told he went *ad Suthweorce,* and ſtayed there till the return of the tide.

99 Pariſhes, &c. Southwark conſiſts of the pariſhes of St Olave, St Saviour, St George, and St Thomas; the pariſh of Chriſt-church, though contiguous to the borough, is in the county of Surry.

The principal church in Southwark is that of *St Saviour,* which was formerly a priory of regular canons. Being dedicated to the Virgin Mary, and ſituated near the bank of the Thames, it was called *St Mary Over Ree,* or *Overy,* by which appellation it is commonly known. This church is built in the manner of a cathedral, with three aiſles from eaſt to weſt and a croſs aiſle. It is reckoned the largeſt pariſh-church in England, the three aiſles firſt mentioned meaſuring 269 feet, in length, and the croſs aiſle 109 feet. The height within, is 47 feet and it has a tower with four ſpires 150 feet high.

Not far from St George's church ſtood the magnificent palace of Charles Brandon duke of Suffolk, the deſerved favourite of Henry VIII. After his death, in 1545, it came into the king's hands, who eſtabliſhed here a royal mint. It at that time was called *Southwark Place,* and in great meaſure preſerved its dignity. Edward VI. once dined in it. His ſiſter and ſucceſſor preſented it to Heath archbiſhop of York as an inn or reſidence for him and his ſucceſſors when ever they repaired to London. As to the mint, it became a ſanctuary for inſolvent debtors; at length becoming the peſt of the neighbourhood, by giving ſhelter to villians of every ſpecies that awakened the attention of parliament: which, by the ſtatues 8 and 9 Will. III. 9 George I. and 11 George I. entirely took away its abuſive privileges.

100 Ancient places of diverſion. In the pariſh of Chriſt church, near the water on Bankſide ſtood, *Paris-garden,* one of the ancient play houſes of the metropolis. Ben Jonſon is reproached by one Decker, an envious critic, with his ill ſucceſs on the ſtage, and in particular with having performed the part of Zuliman at Paris-garden. It ſeems to have been much frequented on Sundays. This profanation (Mr Pennant obſerves) was at length fully publiſhed by the dire accident which befel the ſpectators in 1582, when the ſcaffolding ſuddenly fell, and multitudes of people were killed or miſerably maimed. The omen ſeems to have been accepted; for in the next century the manor of Paris-garden was erected into a pariſh, and a church founded under the name of Chriſt's.

Beyond this place of amuſement were the Bear-gaden and place for baiting of bulls, the *Britiſh circi:* "Herein (ſays Stow) were kept beares, bulls, and other beaſts to be bayted; as alſo maſtives in ſeveral kennels nouriſhed to bayt them. Theſe beares and other beaſts are there kept in plots of ground ſcaffolded about for the beholders to ſtand ſafe." This was then an amuſement for perſons of the firſt rank: the great, if not good, Elizabeth cauſed the French ambaſſadors to be carried to this theatre, to divert them with theſe bloody ſpectacles.

111 The Stews. Not far from theſe ſcenes of cruel paſtime was the *Bordello* or *Stews,* permitted and openly licenſed by government, under certain laws or regulations. They were farmed out. Even a lord-mayor did not diſdain to own them; but rented them to the *Froes,* that is "the bawds," of Flanders. Among other ſingular regulations, no ſtewholder was to admit married women; nor were they to keep open their houſes on Sundays; nor were they to admit any women who had on them the perilous infirmity of burning. Theſe infamous houſes were very properly ſuppreſſed in the reign of Henry VIII.

The biſhop of Wincheſter had formerly a palace here with a park (the ſame that is now called *Southwark-park,*), which is ſince converted into warehouſes and tenements, held by leaſe from the biſhops of that ſee.

112 St Thomas's Hoſpital. Beſides ſeveral alms-houſes, there are here *St Thomas's* and *Guy's hoſpitals,* two of the nobleſt endowments in England. The former was erected in 1215 by Peter de Rupibus biſhop of Wincheſter, who endowed it with land to the amount of L. 343 a year; from which time it was held of the abbots of Bermondſey, one of whom in 1428 granted a right to the maſter of the hoſpital to hold all the lands it was then in poſſeſſion of belonging to the ſaid abbot and convent, the whole revenue of which did not exceed L. 266:17:6 *per annum.* In the year 1551, after the citizens of London had purchaſed of Edward VI. the manor of Southwark and its appurtenances, of which this hoſpital was a part, they expended L. 1100 in repairing and enlarging the edifice, and immediately received into it 260 patients; upon which the king in 1553 incorporated this hoſpital with thoſe of Chriſt-church and Bridewell in the city of London. The building being much decayed, three beautiful ſquares adorned with colonades were erected by voluntary ſubſcription in 1693, to which in 1732 the governors added a magnificent building, conſiſting of ſeveral wards with proper offices. The annual diſburſements of this hoſpital have for many years amounted to L. 8000. The houſe is divided into 19 wards, and is ſaid to contain 474 beds.

113 Guy's Hoſpital. Adjoining to St Thomas's ſtands *Guy's hoſpital,* perhaps the moſt extenſive charitable foundation that ever was eſtabliſhed by one man in private life. The founder of this hoſpital was Thomas Guy, a bookſeller in Lombard-ſtreet, London, who lived to ſee the edifice roofed in; and at his death, in 1724, left L. 283,292, 16s. including the expence of the building, to finiſh and endow it. This hoſpital conſiſts of two capacious ſquares, containing 12 wards and 435 beds. It was incorporated by charter from parliament, and the firſt governors were appointed in 1725.

In St George's Fields, weſtward of the King's-bench priſon, is the *Magdalen Hoſpital* for the reception of penitent proſtitutes; a little farther is ſituated the Aſylum for orphan girls; and not far diſtant is the Weſtminſter Lying-in hoſpital: Inſtitutions, of which the following feeling and animated account is given by Mr Pennant.

114 The Aſylum. “ The *Aſylum* is an inſtitution of a moſt heavenly nature, calculated to ſave from perdition of ſoul and body the brighter part of the creation; ſuch on whom Providence hath beſtowed angelic faces and elegant forms, deſigned as bleſſings to mankind, but too often debaſed to the vileſt uſes. The hazard that theſe innocents conſtantly are liable to from a thouſand temptations, from poverty, from death of parents, from the diabolical pocureſs, and often from the ſtupendous wickedneſs of parents themſelves who have been known to ſell their beauteous girls for the purpoſe of proſtitution, induced a worthy band to found in the year 1758 the aſylum or Houſe of Refuge. Long may it flouriſh, and eternal be the reward of thoſe into whoſe minds ſo amiable a conception entered!

115 The Magdalen Hoſpital. “ To afford means of ſalvation to thoſe unhappy beings who had the ill fortune to loſe the benefits of this divine inſtitution, the *Magdalen Hoſpital* was inſtituted for the reception of the penitent proſtitutes. To ſave from vice is one great merit. To reclaim and reſtore to the dignity of honeſt rank in life, is certainly not leſs meritorious. The joy at the return of one ſinner to repentance is eſteemed by the higheſt authority worthy of the heavenly hoſt. That ecſtaſy I truſt, this inſtitution has often occaſioned. Since its foundation in the ſame year with the former, to December 25th, 1786, not fewer than 2471 have been admitted. Of theſe (it is not to be wondered that long and evil habits are often incurable) 300 have been diſcharged, uneaſy under conſtraint; 45 proved lunatics, and afflicted with incurable fits; 60 have died; 52 never returned from Hoſpitals they were ſent to; 338 diſcharged for faults and irregularities. How to be dreaded is the entrance into the bounds of vice, ſince the retreat from its paths is ſo difficult! Finally, 1608 prodigals have been returned to their rejoicing parents; or placed in reputable ſervices, or to honeſt trades, banes to idleneſs and ſecurities againſt a future relapſe.”—Into this charity, every woman who has been ſeduced (and is not pregnant or diſeaſed), whether recommended or not, may apply for admiſſion to the committee, who meet for that purpoſe on the firſt Tueſday in every month.

116 Lying-in Hoſpital. Akin to thoſe charities is that of the *Lying in Hoſpital:* which is not intended merely for the reception of “ the honeſt matron who can depoſit her burden with the conciouſneſs of lawful love; but alſo for the unhappy wretches whom ſome villain in the unguarded moment has ſeduced, and then left a prey to deſertion of friends, to poverty, want and guilt. Leſt ſuch ‘ may be driven to deſpair by ſuch complicated miſery, and be tempted to deſtroy themſelves and murder their infants,’ here was founded in 1765 this humane preventative the Weſtminſter New Lying-in Hoſpital, in which every aſſiſtance and accommodation requiſite in ſuch ſituations are provided in the moſt attentive and liberal manner. To obviate all objection to its being an encouragement to vice, no one is taken in a ſecond time: but this moſt excellent charity is open to the worthy diſtreſſed matron as often as neceſſity requires. None are rejected who have friends to recommend. And of both deſcriptions upwards of 4000 have experienced its ſalutary effect.”

117 St George's Fields. St George's Fields are now almoſt covered with new-erected buildings, from the ditch at the end of Great Surry-ſtreet, or Burrow's buildings, to the Fiſhmongers almſhouſes, in one direction; and from the Marſhalſea-priſon to the Dog and Duck, in the other direction; with ſeveral irregular indentations in its circumference; and where the principal roads meet an obeliſk has been erected, pointing ont the diſtance it ſtands from different parts of London, Weſtminſter and Blackfriars bridges. Among the buildings which ſerve to embelliſh and improve this entrance to London, Chatham ſquare and and Bridgeſtreet Blackfairs may be particularly ſpecified.

118 Lambeth-palace. At *Lambeth*, the archbiſhops of Canterbury have had a palace. According to Mr Pennant, it was in the earlier times a manor, poſſibly a royal one; for the great Hardiknut died here in 1042, in the midſt of the jollity of a wedding dinner; and here, without any formality, the uſurper Harold is ſaid to have ſnatched the crown and placed it on his own head. At that period it was part of the eſtate of Goda, wife to Walter Earl of Mantes, and Euſtace Earl of Boulogne; who preſented it to the church of Rocheſter but reſerved to herſelf the patronage of the church. It became in 1197 the property of the ſee of Canterbury, by exchange tranſacted between Glanville Biſhop of Rocheſter, and the Archbiſhop Hubert Walter. The building was improved by Langton the ſucceſſor of Walter; but it was afterwards neglected and became ruinous. “ No pious zeal (ſays Mr Pennant) reſtored the place, but the madneſs of prieſtly pride. Boniface, a wrathful and turbulent primate, elected in 1244, took it into his head to become a viſitor of the priory of St Bartholomew, to which he had no right. The monks met him with reverential reſpect, but aſſured him the office did not belong to the biſhop. The meek prelate ruſhed on the ſubprior, knocked him down, kicked, beat, and buffeted him, tore the cope off his back, and ſtamped on it like one poſſeſſed, while his attendants paid the ſame compliments to all the poor monks. The people enraged at his unprieſtly conduct would have torn him to pieces; when he retired to Lambeth, and, by way of expiation, rebuilt it with great magnificence.—At a ſubſequent period it was very highly improved by the munificent Henry Chichely, who enjoyed the primacy from 1414 to 1443. I lament to find ſo worthy a man to have been the founder of a building ſo reproachful to his memory as the Lollards tower, at the expence of near L. 280. Neither Proteſtants or Catholics ſhould omit viſting this tower, the cruel priſon of the unhappy followers of Wickliffe. The vaſt ſtaples and rings to which they were chained before they were brought to the ſtake, ought to make Proteſtants bleſs the hour which freed them from ſo bloody a religion.” During the civil wars of the laſt century, this palace ſuffered greatly; but at the reſtoration, the whole was repaired by Archbiſhop Juxton.

The pariſh church of Lambeth (H), which is at a ſmall diſtance

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(H) In deſcribing this church, Mr Pennant takes occaſion to mention the ſad example of fallen majeſty in the perſon of Mary d'Eſte, the unhappy queen of James II.; who flying with her infant prince from the ruin distance from the place, has a plain tower; and the architecture is of the Gothic of the time of Edward IV. It has very little remarkable in it, except the figure of a pedlar and his dog, painted in one of the windows; and tradition ſays, that the pariſh was obliged to this man for the bequeſt of a piece of land, which bears the name of *the Pedlar's Acre*. In the churchyard is the tomb of old Tradeſcant. Both father and ſon were great travellers; and the former is ſuppoſed to have viſited Ruſſia and moſt parts of Europe, Turkey, Greece, many of the eaſtern countries, Egypt, and Barbary; out of which he introduced multitudes of plants and flowers, unknown before in the gardens. emblematical ſculptures; and bearing the following inſcription, which is both ſingular and hiſtorical: 119 and church.

Know, ſtranger, ere thou paſs, beneath this ſtone
Lye John Tradeſcant, grandſire, father, ſon;
The laſt dy'd in his ſpring; the other two
Liv'd till they had travell'd Art and Nature through,
As by their choice collections may appear,
Of what is rare, in land, in ſea, in air;
Whilſt they (as Homer's Iliad in a nut)
A world of wonders in one cloſet ſhut.
Theſe famous Antiquarians, that had been
Both gardeners to the Roſe and Lily Queen,
Tranſplanted now themſelves, ſleep here; and when
Angels ſhall with their trumpets wake men,
And fire ſhall purge the world, theſe hence ſhall riſe,
And change this garden for a paradiſe.

120 Lambeth-marſh. From Lambeth, eaſtward along the river ſide, was once a long tract of dreary marſh, and ſtill in ſome parts called *Lambeth-marſh*; about the year 1560, there was not a houſe on it from Lambeth palace as far as Southwark. In a ſtreet called *Narrow-wall* (from one of the ancient embankments), is Mrs Conde's noted manufactory of artificial ſtone (I); And at a ſmall diſtance, Meſſ. Beaufoy's great work for making wines (K), and that for making vinegar (L).

121 Great manufactories. This ground, ſo profitable to the proprietors, and ſo productive of revenue to the ſtate, was within memory the ſcene of low diſſipation. Here ſtood Cuper's garden, noted for its fire-works, and the great reſort of the profligate of both ſexes. This place was ornamented with ſeveral of the mutilated ſtatues belonging to Thomas Earl of Arundel, which had been for that purpoſe begged from his lordſhip by one Boyder Cuper, a gardener in the family. The great timber-yards beneath which theſe antiquities were found, are very well worthy of a viſit. One would fear that the foreſts of Norway and the Baltic would be exhauſted, to ſupply the want of the overgrown capital, were we not aſſured that the reſources will ſucceſſively be increaſing equal to the demand of ſucceeding ages.—In this pariſh are alſo the vaſt diſtilleries, till of late the property of Sir Joſeph Mawbey; where are ſeldom leſs than 2000 hogs conſtantly grunting, and kept entirely on the grains.

122 City and liberties of Weſtminſter. III. *City and Liberties of* WESTMINSTER. The city of Weſtminſter derives its name from a *minſter* or abbey, and *weſt*, on account of its ſituation with reſpect to St Paul's cathedral, which was formerly called *Eaſtminſter*. In ancient times this diſtrict ſtood upwards of a mile from the city of London, and contained only two pariſhes, which were thoſe of St Margaret and St John, with two chapels of eaſe, but at preſent it has ſeven other parochial churches, viz. St Clement's Danes, St Paul's Covent-garden, St Mary's le-Strand, St Martin's in the Fields, St Anne's, St James's, and St George's Hanover-ſquare.

Weſtminſter

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ruin impending over their houſe after croſſing the Thames from the abdicated Whitehall, took ſhelter beneath the ancient walls of this church a whole hour, from the rain of the inclement night of December 6th, 1688. Here ſhe waited with aggravated miſery, till a common coach, procured from the next inn, arrived, and conveyed her to Graveſend, from whence ſhe failed, and bid an eternal adieu to theſe kingdoms.

(I) Her repoſitory conſiſts of ſeveral very large rooms filled with every ornament which can be uſed in architecture. The ſtatue, the vaſe, the urn, the rich chimney pieces, and, in a few words, every thing which could be produced out of natural ſtone or marble by the moſt elegant chiſel, is here to be obtained at an eaſy rate.

(K) "Where (ſays Mr Pennant) the foreign wines are moſt admirably mimicked. Such is the prodigality and luxury of the age, that the demand for many ſorts exceeds in a great degree the produce of the native vineyards. We have ſkilful fabricators who kindly ſupply our wants. It has been eſtimated, that half of the port, and five-ſixths of the white wines conſumed in our capital, have been the produce of our home wine preſſes. The product of the duty to the ſtate from a ſingle houſe was in one year, from July 5th 1785, to July 5th 1786, not leſs than L.7;363 : 9 : 8½. The genial banks of the Thames oppoſite to our capital, yield almoſt every ſpecies of white wine; and by a wondrous magic, Meſſ. Beaufoy pour forth the materials for the rich Frontiniac, to the more elegant tables; the Madeira, the Calcavella, and the Liſbon, into every part of the kingdom."

(L) "There is a magnificence of buſineſs (our author remarks) in this ocean of ſweets and ſours, that cannot fail exciting the greateſt admiration: whether we conſider the number of veſſels or their ſize. The boaſted tun at Heydelberg does not ſurpaſs them. On firſt entering the yard, two riſe before you, covered at the top with a thatched dome; between them is a circular turret, including a winding ſtaircaſe, which brings you to their ſummits, which are above 24 feet in diameter. One of theſe conſervatories is full of ſweet wine, and contains 58,109 gallons, or 1,815 barrels of Wincheſter meaſure. Its ſuperb aſſociate is full of vinegar, to the amount of 56,799 gallons, or 1,774 barrels of the ſame ſtandard as the former. The famous German veſſel yields even to the laſt by the quantity of 49 barrels.—Beſides theſe, is an avenue of leſſer veſſels, which hold from 32,500 to 16,974 gallons each. After quitting this Brobdignagian ſcene, we paſs to the acres covered with common barrels: we cannot diminiſh our ideas ſo ſuddenly, but at firſt we imagined we could quaff them off as eaſily as Gulliver did the little hogſheads of the kingdom of Lilliput."

Weſtminſter was anciently called Thorny-iſland, from its having been covered with thorn-buſhes, and encompaſſed by a branch of the Thames, which is ſaid to have run through the ground now called St James's park, from weſt to eaſt, and to have rejoined the river at Whitehall.

123 Government of Weſtminſter. Till the general diſſolution of religious houſes, Weſtminſter was ſubject to the arbitrary rules of its abbot and monks; but in 1541, upon the ſurrender of William Benſon the laſt abbot, Henry VIII. not only turned it into an honour, but created it the ſee of a biſhop, and appointed for a dioceſe the whole county of Middleſex, except Fulham, which belonged to the biſhop of London. This biſhoprick, however, ſoon after its inſtitution, was diſſolved by Edward VI.

The city of Weſtminſter is governed by an high ſteward, an officer of great dignity, who is uſually one of the firſt peers in the realm; and is choſen for life by the dean and chapter of the collegiate church of St Peter. There is alſo a deputy ſteward and a high bailiff, who alſo hold their offices for life; being nominated by the dean and chapter, and confirmed by the high ſteward.

The dean and chapter are inveſted with an eccleſiaſtical and civil juriſdiction within the liberties of Weſtminſter, St Martin's-le-Grand, near Cheapſide, in the city of London, and ſome towns in Eſſex, which are exempted from the juriſdiction of the biſhop of London and the archbiſhop of Canterbury.

124 Churches. *St Margaret's church* was founded by Edward the Confeſſor, ſince which time it has been frequently rebuilt. In the eaſt end of this church is a window curiouſly painted, with the hiſtory of the crucifixion, and with the figures of ſeveral apoſtles and ſaints finely executed. It formerly belonged to a private chapel at Copt-hall, near Epping in Eſſex, and was purchaſed by the officers of this pariſh ſome years ago for 400 guineas. In this church the houſe of commons attends divine ſervice on ſtate holidays.

The *church of St John the Evangeliſt* was erected in 1728, and having ſunk conſiderably whilſt it was building, occaſioned an alteration of the plan. On the north and ſouth ſides are magnificent porticoes, ſupported by vaſt ſtone pillars, as is alſo the roof of the church; at each of the four corners is a beautiful ſtone tower and pinnacle, which were added with the view of making the whole ſtructure ſink equally. The parts of this building are held together by iron bars, which run acroſs even the ailes.

125 Weſtminſter-abbey, and its chapels. The moſt remarkable ſtructure in Weſtminſter is the *abbey-church of St Peter.* On its ſide ſtood once a temple of Apollo, which according to tradition was thrown down by an earthquake in the time of Antoninus Pius; and from the ruins of which, Sebert king of the weſt Saxons raiſed a Chriſtian church, which was ruined by the Danes. It was repaired by Edward the Confeſſor, and given to a few monks; and this ſpot he choſe for his burial-place. Henry III. 160 years after, took down this fabric of Edward's, and erected a new church, which was 50 years in building. It ſuffered much by fire in 1274, but was repaired by Edward I. Edward II. and the abbots. In 1700 this church being much decayed, the parliament granted money for repairing it, and has frequently repeated the bounty ſince that time. The form of the abbey is that of a long croſs: its greateſt length is 489 feet, and the breadth of the weſt front 66 feet; the length of the croſs aile is 189 feet, and the height of the roof 92 feet. At the weſt end are two towers: the nave and croſs aile are ſupported by 50 ſlender pillars of Suſſex marble, excluſive of pilaſters. In the upper and lower ranges there are 94 windows, all which, with the arches, roofs, and doors, are in the Gothic taſte. The inſide of this church is much better executed than the outſide: and the perſpective is good, particularly that of the grand aile. The choir, from which there is an aſcent by ſeveral ſteps to a fine altar-piece, is paved with black and white marble; having 28 ſtalls on the north, the ſame number on the ſouth, and eight at the weſt end. The altar is made of a beautiful piece of marble, the gift of Queen Anne, incloſed by a curious baluſtrade, and upon a pavement of porphyry, jaſper, Lydian, and ſerpentine ſtones laid in the Moſaic ſtyle, at the expence of abbot Ware, A. D. 1272; and is ſaid to be one of the moſt beautiful of its kind in the world. On each ſide of this altar a door opens into St Edward's chapel; round which are 10 other chapels, ranging from the north to the ſouth croſs ailes, and are dedicated, 1. To St Andrew. 2. To St Michael. 3. To St John Evangeliſt. 4. Iſlip's chapel. 5. To St John Baptiſt. 6. To St Paul. 7. Henry V.'s chapel. 8. To St Nicholas. 9. To St Edmund. 10. To St Benedict.

In St Edward's chapel are ſtill to be ſeen the remains of his ſhrine; which, though now in obſcurity, and robbed of all its riches and luſtre, was once eſteemed the glory of England, ſo far as art and riches could make it. Here are the tombs of King Edward I. and ſeveral other kings and queens of England; and here alſo is ſhown the famous chair in which the kings of Scotland uſed to be crowned at Scoon. Henry V.'s chapel is divided from St Edward's by an iron ſcreen, on each ſide of which are ſtatues as big as life.—St Andrew's chapel, which is next to the north croſs, and the others which ſurround the choir are crowded with the monuments of noble perſonages, worthy the attention of the curious—At the corner of St Benedict's chapel, an iron gate opens into the ſouth croſs aile; which from the number of monuments erected therein to celebrate Engliſh poets, has obtained the name of *the poet's corner:* though here we find a moſt magnificent monument erected at the ſouth end in memory of the late John duke of Argyle and Greenwich; another to William Cambden the antiquarian; and others to the celebrated divine Dr Iſaac Barrow, to Thomas Parr who died at the age of 152 years; &c.—The ſouth aile is adorned with 19 curious monuments of the pious, the brave, and the learned; and turning northward from the weſt door, we view a great number more.

126 Henry's chapel. On the eaſt of the abbey, and which, though ſeparate from the other chapels in the choir, ſeems to be one and the ſame building with the abbey, ſtands the chapel of King Henry VII. which that king founded in the year 1502, and was at that time ſtyled the *wonder of the world,* and is now one of the moſt expenſive remains of the ancient Engliſh taſte and magnificence. There is no looking upon it without admiration:

miration: it conveys an idea of the fine taſte of Gothic architecture in that age: and the inſide is ſo noble, majeſtic, and of ſuch curious workmanſhip, that it would take a volume to deſcribe each part with juſtice and propriety.

Its original intention was to be a dormitory for the royal blood: and ſo far the will of the founder has been obſerved, that none have been interred therein but ſuch as have traced their deſcent from ancient kings. The tomb of King Henry VII. is moſt magnificent, incloſed with a ſcreen of caſt braſs, moſt admirably deſigned, and as well executed. Within the rails are the figures of that king and his royal conſort, in their robes of ſtate, on a tomb of black marble: and at the head of this tomb lie the remains of Edward VI. In different parts of this chapel are the monuments of Lewis Stuart duke of Richmond, George Villars duke of Buckingham, John Sheffield duke of Buckingham, Charles Montague marquis of Hallifax, Edward V. and his brother Richard; the vault of James I. and his queen, Anne, and daughter Mary, on which is a ſmall tomb adorned with the figure of a child; a lofty monument of Queen Elizabeth, and another of Mary Queen of Scots; the monuments for Margaret Douglas daughter of Margaret queen of Scots, Margaret counteſs of Richmond mother to Henry VII. the vault of King Charles II. and William III. Queen Mary his conſort, Queen Anne, and Prince George. Over theſe royal perſonages are their effigies (except that of prince George) in wainſcot preſſes, made of wax to reſemble life, and dreſſed in their coronation robes. And at the corner of the great eaſt window, in another wainſcot preſs, ſtands the effigy of Mary ducheſs of Richmond daughter to James duke of Richmond and Lenox, dreſſed in the very robes ſhe wore at the coronation of Queen Anne. On leaving the aiſle, you are ſhown another preſs, containing the effigy of general Monk, who, on account of his loyalty, and the part he took in the reſtoration of King Charles II. had a vault appropriated to him and his family amongſt the royal blood.

In a fine vault under Henry the VII.'s chapel, is the burying-place of the preſent royal family, erected by his late majeſty king George II. Adjoining to the abbey are the cloyſters, built in a quadrangular form, with piazzas towards the court, where ſeveral of the prebendaries have their houſes.

127 Weſtminſter School. Near the abbey church is the King's ſchool, uſually called *Weſtminſter School.* It was originally founded in 1070, and a ſecond time by Queen Elizabeth in 1560, whence it is ſometimes called the *Queen's College*: and is at preſent one of the greateſt ſchools in the kingdom. The learned antiquary Mr Cambden was once maſter of it, and Ben Jonſon one of his ſcholars. Dr Buſby, who was maſter upwards of 50 years, greatly contributed to keep up its reputation, formed its muſeum, and improved both the maſter's and his prebendal houſe.—This ſchool, inſtead of one maſter and one uſher as at firſt, has now an upper and under maſter, and five uſhers, who have about 400 youths under their tuition. A plan was ſet on foot when the preſent archbiſhop of York was maſter, for building a college for the uſe of the ſtudents, but this did not ſucceed.

128 Weſtminſter-hall. On the north-eaſt ſide of the abbey is an old Gothic building called *Weſtminſter-hall,* firſt built by William Rufus as an addition to a royal palace, and afterwards rebuilt by Richard II. in the year 1397. It is reckoned one of the largeſt rooms in Europe, being 200 feet long, 70 broad, and 90 high, ſupported only by buttreſſes. The roof is of timber, and was ſome years ago ſlated, the old covering of lead being reckoned too heavy. It is paved with ſtone. In this ſpacious room the kings of England have generally held their coronation and other ſolemn feaſts; and it is uſed for the trial of peers. Since the reign of Henry III. the three great courts of Chancery, King's Bench, and Common Pleas, have been held in ſeparate apartments of this hall; and the court of Exchequer above ſtairs.

129 Houſe of Commons. Adjoining to the ſouth-eaſt angle of Weſtminſter hall is a building formerly called *St Stephen's Chapel,* from its having been dedicated to that ſaint. It was founded by King Stephen; and in 1347 was rebuilt by King Edward III. who converted it to a collegiate church; but ſince it was ſurrendered to Edward VI. it has been uſed for the aſſembly of the repreſentatives of the commons of England, and is now generally called the *Houſe of Commons.* The benches, which aſcend behind one another as in a theatre, are covered with green cloth; the floor is matted; and round the room are wainſcot galleries, ſupported by cantilevers adorned with carved work, in which ſtrangers are often permitted to ſit and hear the debates.

130 Houſe of Lords. On the ſouth ſide of the hall is the *Houſe of Lords,* ſo called from being the place where the peers of Great Britain aſſemble in parliament. It is an oblong room, not quite ſo large as the houſe of commons; and is hung with fine old tapeſtry, repreſenting the defeat of the Spaniſh Armada in 1588. The deſign was drawn by Cornelius Vroom, and the tapeſtry executed by Francis Spiering. It was not put up till the year 1650, two years after the extinction of monarchy, when the houſe of lords was uſed as a committee-room for the houſe of commons. The heads of the naval heroes who commanded on the glorious day form a matchleſs border round the work, animating poſterity to emulate their illuſtrious example. Here is a throne for the king, with ſeats on the right and left for ſuch peers of the realm as are of the blood royal. Before the throne are three broad ſeats; on the firſt of which, next the throne, ſits the Lord Chancellor, or keeper of the great ſeal, who is ſpeaker of the houſe of peers; and on the other two ſit the judges, the maſter of the rolls, or the maſters in chancery, who attend occaſionally to give their opinions on points of law. The two archbiſhops ſit at ſome diſtance from the throne on the right hand, and the other biſhops in a row under them. All the benches are covered with red cloth ſtuffed with wool. Here likewiſe, by a late order of the houſe, a gallery for ſtrangers has been erected.

131 Prince's Chamber, &c. Adjoining to the houſe of lords is the *Prince's Chamber,* where the king is robed when he comes to the parliament. On the other ſide is the *Painted Chamber,* which is ſaid to have been Edward the Confeſſor's bed-chamber, and the room in which the parliaments were anciently opened. Here conferences are often held between the two houſes, or their committees. Contiguous to thoſe is an apartment called the *Court of Requeſts*, where ſuch as have buſineſs in either houſe may attend.

132 Weſtminſter bridge. Near theſe buildings is a bridge over the Thames, called *Weſtminſter-Bridge*, accounted one of the moſt complete and elegant ſtructures of the kind in the known world. It is built entirely of ſtone, and extends over the river at a place where it is 1223 feet broad; which is about 300 feet broader than at London bridge. On each ſide is a fine balluſtrade of ſtone, with places of ſhelter from the rain. The width of the bridge is 44 feet, having on each ſide a fine foot-way for paſſengers. It conſiſts of 14 piers, and 13 large and two ſmall arches, all ſemicircular, that in the centre being 76 feet wide, and the reſt decreaſing four feet each from the other, ſo that the two leaſt arches of the 13 great ones are each 52 feet. It is computed that the value of 40,000l. in ſtone and other materials is always under water. This magnificent ſtructure was begun in 1739, and finiſhed in 1750, at the expence of 389,000l. defrayed by the parliament. It was built after the deſign of Monſ. Labelye, an engenious architect, a native of France.

133 Whitehall. On the bank of the Thames, at the eaſt confines of St Margaret's pariſh, was a palace called *White-hall*, originally built by Hubert de Burgh earl of Kent, before the middle of the 13th century. It afterwards devolved to the archbiſhop of York, whence it received the name of *York Place*, and continued to be the city reſidence of the archbiſhops till it was purchaſed by Henry VIII. of cardinal Wolſey in 1530. At this period it became the reſidence of the court; but in 1697 was deſtroyed by accidental fire, all except the banqueting-houſe, which had been added to the palace of Whitehall by James I. according to a deſign of Inigo Jones. This is an elegant and magnificent ſtructure of hewn ſtone, adorned with an upper and lower range of pillars, of the Ionic and Compoſite orders; the capitals are enriched with fruit and foliages, and between the columns of the windows. The roof is covered with lead, and ſurrounded with a baluſtrade. The building chiefly conſiſts of one room of an oblong form, 40 feet high, and a proportionable length and breadth. The ceiling is painted by the celebrated Sir Peter Paul Rubens. It is now uſed only as a chapel-royal, and the other part of the houſe is occupied with ſtate-offices.

134 Horſe-guards. Oppoſite to the banqueting-houſe ſtands the *Horſe-guards*, ſo called from being the ſtation where that part of his majeſty's troops uſually do duty. It is a ſtrong building, of hewn ſtone, conſiſting of a centre and two wings. In the former is an arched paſſage into St James's Park; and over it, in the middle, riſes a cupola. In a part of the building is the War-office. Near the Horſe-guards is the *Treaſury;* a large building, which fronts the Parade in St James's Park; and where the board of treaſury is kept.

135 Admiralty office. Eaſtward of the Horſe-guards is the *Admiralty-Office*, a large pile, built with brick and ſtone. The front towards Whitehall has two deep wings, and a lofty portico ſupported by four large ſtone pillars. A piazza, conſiſting of beautiful columns, runs almoſt from one end to the other. The wall before the court has been lately built in an elegant manner, and each ſide of the gate is ornamented with naval emblems. Beſides a hall, and other public apartments, here are ſpacious houſes for ſeven commiſſioners of the admiralty.

136 Charing-croſs. At a little diſtance from the admiralty, where three capital ſtreets terminate, is a large opening called *Charing-croſs*, from one of the croſſes which king Edward I. cauſed to be erected in memory of his queen Eleanor, and *Charing* the name of a village in which it was built. The croſs remained till the civil wars in the reign of Charles I. when it was deſtroyed by the fanatics, as a monument of popiſh ſuperſtition; but after the Reſtoration, an equeſtrian ſtatue of Charles I. was ſet up in its ſtead. This, which is of braſs, and finely executed, continues to be an ornament to the place. It was made in 1633, at the expence of the Howard-Arundel family. The parliament ſold it to a brazier in Holborn, with ſtrict orders to break it to pieces; but he concealed it under ground till the Reſtoration, when it was ſet up in 1678.

137 Queen's Palace. At the weſt end of the Mall, in St James's Park, which begins near Charing-croſs, ſtands the *Queen's Palace*. It was originally known by the name of *Arlington-houſe;* but being purchaſed by the late duke of Buckingham's father, who rebuilt it from the ground in 1703, it was called *Buckingham-houſe*, till the year 1762, when it was purchaſed by his majeſty for a royal reſidence. It is built of brick and ſtone, having in the front two ranges of pilaſters of the Corinthian and Tuſcan orders. It has a ſpacious court-yard, incloſed with iron rails, fronting St James's Park, with offices on each ſide, with two pavilions, ſeparated from the manſion-houſe by colonades of the Tuſcan, Doric, and Ionic orders. His majeſty has here built a fine library, in an octagonal form, beſides ſeveral other additions.

138 St James's. Eaſtward of the queen's palace ſtands *St James's*, an old building, which, till the former was purchaſed by the crown, had been the town-reſidence of the royal family ſince the burning of Whitehall in 1697. This palace was built by Henry VIII. and obtained its name from an hoſpital which formerly ſtood on the ſpot. It is an irregular building, of a mean appearance without, but contains ſeveral magnificent apartments. Here the court and levees are ſtill kept, and moſt of the perſons belonging to the houſhold have their reſidence. The chapel of the hoſpital was converted to the uſe of the royal family, as it now remains, and is a royal peculiar, exempted from all epiſcopal juriſdiction. 139 The park and Mall. When this palace was built, it abutted in the ſouth-weſt upon an uncultivated ſwampy tract of ground, which the king incloſed and converted into a park, called from the palace *St James's Park*. He alſo laid it out into walks, and collected the water into one body. It was afterwards much enlarged and improved by king Charles II. who planted it with lime trees, and formed a beautiful viſta, near half a mile in length, called the *Mall*, from its being adapted to a play at bowls diſtinguiſhed by that name. He alſo formed the water into a canal 100 feet broad and 2800 feet long; and furniſhed the park with a decoy, and other pond for water-fowl; but thoſe have lately been

been deſtroyed, on account of the unwholeſome vapours which they excited.

In a line with St James's palace, on the eaſt ſide, is *Marlborough Houſe*; which belongs to the duke of Marlborough, and is a large brick edifice, ornamented with ſtone.

140 The Strand when firſt formed.

Eaſtward from Charing-croſs, runs that fine ſtreet the *Strand*, which terminates at Temple-bar. In the year 1353 the whole of it was an open highway, with gardens to the water-ſide. In that year it was ſo ruinous, that Edward III. by an ordinance directed a tax to be raiſed upon wool, leather, wine, and goods carried to the ſtaple at Weſtminſter, from Temple-bar to Weſtminſter abbey, for the repair of the road; and that all owners of houſes adjacent to the highway ſhould repair as much as lay before their doors. Before the above period, it entirely cut off Weſtminſter from London; nothing intervened except the ſcattered houſes, and a village which afterwards gave name to the whole; and St Martin's ſtood literally in the fields. But about the year 1560 a ſtreet was formed looſely built; for all the houſes on the ſouth ſide had great gardens to the river, were called by their owners names, and in after-times gave name to the ſeveral ſtreets that ſucceeded them, pointing down to the Thames; each of them had ſtairs for the conveniency of taking boat, of which many to this day bear the names of the houſes. As the court was for centuries either at the palace of Weſtminſter or Whitehall, a boat was the cuſtomary conveyance of the great to the preſence of their ſovereign. The north ſide was a mere line of houſes from Charing-croſs to Temple-bar: all beyond was country. The gardens which occupied part of the ſite of Convent-garden were bounded by fields, and St Giles's was a diſtant country village. The capital found itſelf ſo ſecure in the vigorous government of Queen Elizabeth, that, by the year 1600, moſt conſiderable additions were made to the north of the long line of ſtreet juſt deſcribed. St Martin's-lane was built on both ſides. St Giles's church was ſtill inſulated: but Broad-ſtreet and Holburn were Completely formed into ſtreets with houſes all the way to Snow-hill. Convent-garden and Lincoln's-inn fields were built, but in an irregular manner. Drury-lane, Clare-ſtreet, and Long-acre, aroſe in the ſame period.

141 Northumberland Houſe.

Almoſt contiguous to Charing-croſs, and upon the ſouth ſide of the Strand, is that noble palace called *Northumberland-houſe*, which ſtands on the ſite of the hoſpital of St Mary Rounceval. Henry VIII. granted it to Sir Thomas Caverden. It was afterwards transferred to Henry Howard earl of Northamton; who, in the time of James I. built here a houſe and called it after his own name. He left it to his kinſman the earl of Suffolk, lord treaſurer; and by the marriage of Algernoon Percy earl of Northumberland, with Eliſabeth daughter of Theophilus earl of Suffolk, it paſſed into the houſe of the preſent noble owner. The greater part of the houſe was built by Bernard Janſen, an architect in the reign of James I. The front next the ſtreet was begun by Algernoon in 1748, and finiſhed by the preſent duke, who married his daughter. Two additional wings to the front next the Thames, and a variety of other improvements both in building and furniture, have contributed to render this houſe the largeſt and moſt magnificent in London. It contains a gallery of 106 feet long by 26 wide moſt ſuperbly furniſhed.

142 Durham Yard.

A ſhort way eaſtward, on the ſame ſide, ſtood *Durham Yard*, which took i's name from a place built originally by the illuſtrious Thomas de Hatfield, elected biſhop of Durham in 1345; deſigned by him for the town reſidence of him and his ſucceſſors. At this place, in 1540, was held a moſt magnificent feaſt, given by the challengers of England, who had cauſed to be proclaimed, in France, Flanders, Scotland, and Spain, a great and triumphant Juſting to be holden at Weſtminſter, for all comers that would undertake them. But both the challengers and defendants were Engliſh. After the gallant ſports of each day, the challengers rode unto this Durham-houſe, where they kept open houſehold, and feaſted the king and queen (Anne of Cleves) with her ladies, and all the court. In the reign of Edward VI. the mint was eſtabliſhed in this houſe, under the management of Sir William Sharrington, and the influence of the aſpiring Thomas Seymour, lord admiral. Durham-houſe was reckoned one of the royal palaces belonging to queen Elizabeth; who gave the uſe of it to the great Sir Walter Raleigh.

143 The Adelphi.

Durham-yard is now filled with a moſt magnificent maſs of building, called the *Adelphi*, in honour of two brothers, the ingenious Adams, its architects. Beſides its fine lodgings, it is celebrated for its enchanting proſpect, the utility of its wharfs, and its ſubterraneous apartments anſwering a variety of purpoſes of general benefit.

144 The Savoy.

Farther on ſtand the ruins of the *Savoy*. Henry III. had granted to Peter of Savoy, uncle to his queen Eleanor, daughter of Berrrenger of Provence, all the houſes upon the Thames where this building now ſtands, to hold to him and his heirs, yielding yearly at the Exchequer three barbed arrows for all ſervices. This prince founded the Savoy, and beſtowed it on the foreign hoſpital of Montjoy. Queen Eleanor purchaſed it, and beſtowed it on her ſon Edmund earl of Lancaſter. It was rebuilt in a moſt magnificent manner by his ſon Henry. It was made the place of confinement of John king of France in 1356, after he was taken priſoner at the battle of Poitiers. In 1381 it was entirely deſtroyed by Wat Tyler, out of ſpleen to the great owner John of Gaunt. Henry VII. began to rebuild it, with a deſign of forming it into an hoſpital for a hundred diſtreſſed people, and Henry VIII. completed the deſign. The revenues, at the ſuppreſſion by Edward VI. amounted to above 500 l. a year. Queen Mary reſtored it; and her maids of honour, with exemplary piety, furniſhed it with all neceſſaries. It was again ſuppreſſed by Queen Elizabeth; and at preſent part ſerves as lodgings for private people, for barracks, and a ſcandalous infectious priſon for the ſoldiery and for tranſport-convicts.

145 Somerſet-houſe.

A little to the eaſtward ſtood *Somerſet-houſe*, a palace built by Somerſet the Protector in the time of Edward VI.; and to make way for which he demoliſhed a great number of buildings without making any recompence to the owners. Part of the church of St John of Jeruſalem and the Tower were blown up for the ſake of the materials; and the cloiſters on the north ſide of St Paul's, with the charnel-houſe and chapel, underwent the ſame fate; the tombs being deſtroyed, and the bones thrown into Finſbury-fields. This happened in 1549; but it is probable that he did not live to inhabit the palace he built, as he was executed in the year 1552. After his death the palace fell to the crown; and it became an occaſional place of reſidence firſt to Queen Elizabeth, and afterwards to Catherine queen to king Charles II. It was built in a ſtyle of architecture compounded of the Grecian and Gothic; and the back, front, and water-gate, were done from a deſign of Inigo Jones, about the year 1623. A chapel was begun the ſame year by that architect, and finiſhed ſome time after. The whole of this ſtructure was demoliſhed in 1775, in conſequence of an act of parliament; and a moſt magnificent edifice, from a deſign by Sir William Chambers, has been erected for the accommodation of all the public offices,—thoſe of the Treaſury, the Secretary of State, the Admiralty, the War, and the Exciſe, excepted. The Royal Society, and the Society of Antiquarians, hold their meetings here, in apartments which have been allotted to them by royal munificence; and here alſo are annually exhibited the works of the Britiſh painters and ſculptors. The terrace on the ſouth ſide is a walk bounded by the Thames, and unparalleled for grandeur and beauty of view.

146 St Martin's and other churches. The church of St Martin is diſtinguiſhed by the name of *St Martin's in the Fields*, from its ſituation, which was formerly a field, with only a few ſcattered houſes. The church being decayed, was rebuilt by Henry VIII. and again by James I. but not being large enough to accommodate the inhabitants of the pariſh it was augmented in 1767, at the charge of Prince Henry, eldeſt ſon of James I. and ſeveral of the nobility. After many expenſive reparations, however, it was entirely taken down in 1720, and a new church began, which was finiſhed in 1726. This is an elegant edifice, built of ſtone On the weſt front is a noble portico of Corinthian columns, ſupporting a pediment, in which are repreſented the royal arms in bas relief. The aſcent to the portico is by a flight of very long ſteps. The length of this church is about 140 feet, the breadth 60, and height 45. It has a fine arched roof ſuſtained by ſtone columns of the Corinthian order. The ſteeple has a beautiful ſpire, and one of the beſt rings of bells in London.

St James's Church was built in the reign of Charles II. at the expence of Henry earl of St Alban's, and other neighbouring inhabitants. The building is of brick and ſtone, about 84 feet long, 60 broad, and 45 feet high, with a handſome ſteeple 150 feet in height

St George's Church, near Hanover-ſquare, is a beautiful ſtructure. This was one of the fifty new churches erected within the bills of mortality, by act of parliament, in the reign of Queen Anne. The ground for the edifice was given by the late lieutenant-general Stewart, who alſo left 4000l. to the pariſh, towards erecting and endowing a charity ſchool; which, by additional benefactions and ſubſcriptions, is become very conſiderable.

147 Covent Garden. The greater part of the pariſh of *St Paul's Covent-garden*, was anciently a garden, belonging to the abbot and convent of Weſtminſter, and was then called *Convent-Garden*, a name corrupted into Covent, and more generally Common-garden. In 1552, Edward VI. gave it to the earl of Bedford, with an adjoining field, formerly called the *Seven Acres*, but now, being turned into a long ſtreet, called *Long-acre*. The church of St Paul's, Covent-garden, was built by Inigo Jones, and is eſteemed one of the moſt ſimple and perfect pieces of architecture in England. In the front is a plain portico of the Tuſcan order, with maſſy columns. Before the church is a ſquare area, containing about three acres of ground, called *Covent-garden market*, and is the beſt in England for herbs, fruit, and flowers. On the north, and part of the eaſt ſide, is a magnificent piazza, deſigned by Inigo Jones

148 St. Mary le-Strand. Next to the pariſh of St Paul, Covent-garden, is that of *St Mary le Strand*. This is alſo one of the fifty new churches built in the reign of Queen Anne, and is a handſome piece of architecture, though not very extenſive. At the entrance, on the weſt ſide, is an aſcent by a flight of ſteps, in a circular form, which leads to a ſimilarly ſhaped portico of Ionic columns, covered with a dome, that is crowned with a vaſe. The columns are continued along the body of the church, with pilaſters of the ſame order at the corners; and in the intercolumniations are niches handſomely ornamented. Over the dome is a pediment ſupported by Corinthian columns, which are alſo continued round the body of the ſtructure, over thoſe of the Ionic order. A handſome balluſtrade is carried round the top of the church, and adorned with vaſes.

A little eaſtward from the preceding church is that of *St Clement's Danes*, ſituated likewiſe in the Strand. A church is ſaid to have ſtood in this place ſince about the year 700; but the preſent ſtructure was begun in 1680, deſigned by Sir Criſtopher Wren. It is built of ſtone, with two rows of windows, the lower plain, but the upper ornamented; and the termination is by an attic, the pilaſters of which are covered with vaſes. On the ſouth ſide is a portico, covered with a dome, ſupported by Ionic columns; and oppoſite to this is another. The ſteeple is beautiful, and of a great height.

The *church of St George*, Bloomſbury, is alſo one of the fifty new churches erected by act of parliament. It is diſtinguiſhed from all the reſt by ſtanding ſouth and north, and by the ſtatue of King George I. at the top of its pyramidal ſteeple.

149 Foundling and other Hoſpitals. In Lamb's Conduit-fields, on the north ſide of the town, is a large and commodious ſtructure, called the *Foundling-hoſpital*, for the reception of expoſed and deſerted children. This laudable charity was projected by ſeveral eminent merchants in the reign of queen Anne; but was not carried into execution till many years afterwards, when a charter for its eſtabliſhment was obtained, through the indefatigable aſſiduity of Mr Thomas Coram, the commander of a merchant veſſel, who ſpent the remainder of his life in promoting this deſign. From the time of its inſtitution, the parliament has occaſionally granted conſiderable ſums for its ſupport; and in ſome years upwards of 6000 infants have been received.

Not far from hence is an *Hoſpital for the Small-pox*;

and in different parts of the town there are others, either for the ſick of all kinds, or thoſe in particular circumſtances. Of the latter are ſeveral *Lying-in-hoſpitals*, and the *Lock-hoſpital* for female patients in the venereal diſeaſe. Of the former are *St George's* and the *Middleſex hoſpitals*, beſides ſeveral infirmaries.

150 **Gray's Inn.** *Gray's-Inn* is one of the four principal inns of court; which, though ſituated within the limits of the pariſh of St Andrew, Holborn, is yet without the liberties of the city of London. It took its name from an ancient family of the name of Gray, which formerly reſided here, and in the reign of Edward III. demiſed it to ſome ſtudents in the law; but it is ſaid to have been afterwards conveyed to the monks of Shene, near Richmond in Surry, who leaſed it to the ſociety of the Inn. It was held by this tenure till the diſſolution of the monaſteries, when Henry VIII. granted it to the ſociety in fee-farm. This inn conſiſts chiefly of two quadrangles, and has an old hall well built of timber, with a chapel in the Gothic ſtyle. Here is alſo a good library, and the Inn is accommodated with a ſpacious garden.

151 **Lincoln's Inn.** *Lincoln's-Inn*, another of the four principal inns of court, was originally the palace of Ralph Neville biſhop of Chicheſter, and chancellor of England about the year 1226. It afterwards devolved to the earl of Lincoln, who converted it into a court for the ſtudents of law about the year 1310. From him it received the name of Lincoln's inn, and conſiſted only of what is now called the old ſquare, which is entered from Chancery-lane. At preſent this ſquare contains, beſides buildings for the lawyers, a large hall where the lord chancellor hears cauſes in the ſittings after term. To this inn belongs likewiſe a fine garden, which has lately been diminiſhed by the building of ſome large and commodious offices, for the uſe of the ſix clerks in the court of Chancery, &c.

152 **Charter-houſe,** In the pariſh of St James, Clerkenwell, is an hoſpital called the *Charter-houſe*, which is a corruption of the word *chartreux*, a name formerly uſed for a convent or priory of the Carthuſians, which this place formerly was. After the diſſolution of monaſteries it fell to the earl of Suffolk, who diſpoſed of it to Thomas Sutton, Eſq; a citizen of London in the time of king James I. for L.13,000. The purchaſer intending it for an hoſpital, applied to the king for a patent, which he obtained in 1611, and the grant was confirmed by parliament in 1623. Mr Sutton having expended L.7000 in fitting up the buildings, gave it the name of king James's hoſpital, and endowed it with lands to the amount of near L.4500 a-year, for the maintenance of 80 gentlemen, merchants, or ſoldiers, who ſhould be reduced to indigent circumſtances; and 40 boys to be inſtructed in claſſical learning. The men are provided with handſome apartments, and all the neceſſaries of life except clothes; inſtead of which each of them is allowed a gown, and L.7 a-year. Of the boys, 29 are at a proper time ſent to the univerſity, where each has an allowance of L.20 a-year for eight years. Others who are judged more fit for trade, are put out apprentices, and the ſum of L.40 is given with each of them. As a farther encouragement to the ſcholars, there are nine eccleſiaſtical preferments in the gift of the governors. It is alſo by the recommendation of the latter that all penſioners and youths are received into the hoſpital. They conſiſt of 16, of which number the king is always one, and the others are generally noblemen of the firſt rank. To this hoſpital belong a maſter, a preacher, two ſchoolmaſters, a phyſician, a regiſter, a receiver, a treaſurer, a ſteward, an auditor, and other officers: and the annual revenues of it being now increaſed to upwards of L.6000, five men and four boys have been added to the original number.

153 **Aſke's Hoſpital.** In the pariſh of St Luke ſtands the haberdaſhers alms-houſe, or *Aſke's Hoſpital*, ſo called from having been erected by the company of haberdaſhers, purſuant to the will of Robert Aſke, Eſq; one of their members, who left 30,000 for the building and the relief of 20 poor members of the company; beſides the maintenance and education of 20 boys, ſons of decayed freemen of the ſame company. This is a large edifice of brick and ſtone, 400 feet long, with a piazza in front 340 feet in length, conſiſting of ſtone columns of the Tuſcan order. In the middle of the building is a chapel adorned with columns, entablatures, and pediment of the Ionic order; and under the pediment is a niche, with a ſtatue of the founder. In the ſame pariſh is the Iron-mongers hoſpital, likewiſe a large building.

In the pariſh of St Mary, Whitechapel, ſtands the *London Hoſpital*, for the reception of the ſick. It is a large building, and was erected a few years ſince by voluntary contribution. Here are alſo ſome conſiderable alms-houſes.

154 **Houſes of the Nobility.** Within the precincts of Weſtminſter are ſeveral ſtately houſes belonging to the nobility, ſome of which have been already mentioned. Of the others, the moſt remarkable at preſent are, Burlington-houſe, Devonſhire-houſe, Egremont-houſe, and Bedford-houſe; Carleton-houſe, the magnificent abode of the prince of Wales, and the ſuperb reſidence erected by the duke of York between the treaſury and the horſe-guards.

155 **Britiſh Muſeum,** To theſe may be added *Montagu-houſe* (now the Britiſh Muſeum); which was built on a French plan by the firſt duke of Montagu, who had been ambaſſador in France. The ſtaircaſe and cielings were painted by Rouſſeau and La Foſſe: the apotheoſis of Iris, and the aſſembly of the gods, are by the laſt. It was purchaſed of the duke's heirs by parliament, for uniting together the Royal Cottonian, Harleian, Sloanian, and other collections of books, MSS. coins, antiquities, ſubjects in natural hiſtory, &c.&c. for the public uſe, for which it is excellently adapted. The firſt of theſe libraries contains the books and MSS. of the princes from Henry VII. to Charles II.; the ſecond the MSS. collected by Sir Robert Cotton, his ſon, and grandſon Sir John, which laſt gave it to the public, by act 12 and 13 William III. c. 7. The Harleian collection of MSS. was formed by Edward earl of Oxford, and purchaſed by government in 1753, at the ſame time with the library, MSS. and natural curioſities of Sir Hans Sloane. This laſt coſt Sir Hans L.50,000; and he left it, by will, to the uſe of the public, on condition that the parliament would pay L.20,000 to his executors. It comprehends an amazing number of curioſities: among which are, the library, including books of drawings, MSS. and prints,

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amounting to about 50,000 volumes ; medals and coins, ancient and modern, 20,000 ; cameos and intaglios, about 700; ſeals, 268 ; veſſels, &c. of agate, jaſper, &c. 542; antiquities, 1125; precious ſtones, agates, jaſper, &c. 2256 ; metals, minerals, ores, &c. 2725 ; cryſtal, ſpars, &c. 1864; foſſils, flints, ſtones, 1275; earths, ſands, ſalts, 1035; bitumens ſulphurs, ambers, &c. 399 ; talcs, micæ, &c. 388 ; corals, ſpunges, &c. 1421; teſtacea, or ſhells, &c. 5843; echini, echinitæ &c. 659; aſteriæi trochi, entrochi, &c. 241; cruſtaceæ, crabs, lobſters, &c. 363; ſtellæ marinæ, ſtar-fiſhes, &c. 173; fiſh, and their parts, &c. 1555; birds, and their parts, eggs, and neſts, of different ſpecies, 1172 quadrupeds, &c. 1886; vipers, ſerpents, &c. 521; inſects, &c. 5439; vegetables, 12,506; hortus ſiccus, or volumes of dried plants, 334; humani, as calculi, anatomical preparations, 756 ; miſcellaneous things, natural, 2098; mathematical inſtruments, 55. A catalogue of all the above is written in a number of large volumes. It is a large and magnificent building; and has behind it a garden, conſiſting nearly of nine acres.

156 Principal ſquares, &c.

Beſides a great number of ſpacious ſtreets, which are daily increaſing, this part of the metropolis is ornamented with ſeveral magnificent ſquares, viz. Groſvenor-ſquare, Berkley ſquare, Portman-ſquare, Cavendiſh-ſquare, Hanover-ſquare, St James's-ſquare, Soho-ſquare, Bloomſbury-ſquare, Queen's-ſquare, Lincoln's-Inn-fields, Leiceſter-ſquare, Red-Lion-ſquare ſome of which have been particularly deſcribed ; not to mention others that are at preſent building. In general, the new buildings in the liberty of Weſtminſter have increaſed to a prodigious degree; inſomuch that they reach as far as Marybone to the north, Piccadilly to the ſouth, and Hyde-park wall to the weſt.

157 London anciently inconvenient and unhealthy.

Before the conflagration in 1666, London (which, like moſt other great cities, had ariſen from ſmall beginnings) was totally inelegant, inconvenient, and unhealthy, of which latter misfortune, many melancholy proofs are authenticated in hiſtory, and which without doubt, proceeded from the narrowneſs of the ſtreets, and the unaccountable projections of the buildings, that confined the putrid air, and joined with other circumſtances, ſuch as the want of water, rendered the city ſeldom free from peſtilential devaſtation. The fire which conſumed the greateſt part of the city, dreadful as it was to the inhabitants at that time, was productive of conſequences which made ample amends for the loſſes ſuſtained by individuals: a new city aroſe on the ruins of the old ; but, though more regular, open convenient, and healthful than the former, yet, it by no means anſwered to the characters of magnificence or elegance, in many particulars; and it is ever to be lamented (ſuch was the infatuation of thoſe times), that the magnificent, elegant, and uſeful plan of the Great Sir Chriſtopher Wren, was totally diſregarded, and ſacrificed to the mean and the ſelfiſh views of private property views which did irreparable injury to the citizens themſelves and to the nation in general: for had that great architect's plan been followed, what has often been aſſerted muſt have been the reſult; the metropolis of that kingdom would inconteſtably have been the moſt magnificent and elegant city in the univerſe, and of conſequence muſt, from the prodigious reſort of foreigners of diſtinction and taſte who would have viſited it, have become an inexhauſtible fund of riches to that nation. But as the deplorable blindneſs of that age has deprived them of ſo valuable an acquiſition, it is become abſolutely neceſſary that ſome efforts ſhould be made to render the preſent plan in a greater degree anſwerable to the character of the richeſt and moſt powerful people in the world.

London.

138 Its plan ſtill defective.

The plan of London, in its preſent ſtate, will in many inſtances appear to very moderate judges to be as injudicious a diſpoſition as can eaſily be conceived for a city of trade and commerce, on the borders of ſo noble a river as the Thames. The wharfs and quays on its banks are extremely mean and inconvenient; and the want of regularity and uniformity in the ſtreets of the city of London, and the mean avenues to many parts of it, are alſo circumſtances that greatly leſſen the grandeur of its appearance. Many of the churches and other public buildings are likewiſe thruſt up in corners, in ſuch a manner as might tempt foreigners to believe that they were deſigned to be concealed. The improvements of the city of London for ſome years paſt have, however, been very great ; and the new ſtreets, which are numerous, are in general more ſpacious, and built with greater regularity and elegance.

159 Great improvements.

The very elegant and neceſſary method of paving and enlightening the ſtreets is alſo felt in the moſt ſenſible manner by all ranks and degrees of people. The roads are continued for ſeveral miles around upon the ſame model ; and, excluſive of lamps regularly placed on each ſide, at ſhort diſtances, are rendered more ſecure by watchmen ſtationed within call of each other. Nothing can appear more brilliant than thoſe lights when viewed at a diſtance, eſpecially where the roads run acroſs; and even the principal ſtreets, ſuch as Pall-Mall, New Bond-ſtreet, Oxford-ſtreet, &c. convey an idea of elegance and grandeur.

160 Wealth and grandeur of this vaſt metropolis.

London, then, in its large ſenſe, including Weſtminſter, Southwark, and part of Middleſex, forms one great metropolis, of vaſt extent and of prodigious wealth. When conſidered with all its advantages, it is now what ancient Rome once was ; the ſeat of liberty, the encourager of arts, and the admiration of the world. It is the centre of trade ; has an intimate connection with all the counties in the kingdom ; and is the grand mart of the nation, to which all parts ſend their commodities, from whence they are again ſent back into every town in the nation and to every part of the world. From hence innumerable carriages by land and water are conſtantly employed : and from hence ariſes that circulation in the national body which renders every part healthful, vigorous, and in a proſperous condition ; a circulation that is equally beneficial to the head and the moſt diſtant members. Merchants here are as rich as noblemen ; witneſs their incredible loans to government : and there is no place in the world where the ſhops of tradeſmen make ſuch a noble and elegant appearance, or are better ſtocked.

261 Its excellent ſituation for commerce.

The Thames on the banks of which London is ſituated, is a river which, though not the largeſt, is the richeſt and moſt commodious for commerce of any

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in the world. It is continually filled with fleets, ſailing to or from the moſt diſtant climates: and its banks from London-bridge to Blackwall, form almoſt one continued great magazine of naval ſtores: containing three large wet docks, 32 dry-docks, and 33 yards for the building of ſhips for the uſe of the merchants beſides the places allotted for the building of boats and lighters, and the king's yards lower down the river for the building of men of war. As the city is about 60 miles diſtant from the ſea, it enjoys by means of this beautiful river all the benefits of navigation, without the danger of being ſurpriſed by foreign fleets, or of being annoyed by the moiſt vapours of the ſea. It riſes regularly from the water-ſide, and, extending itſelf on both ſides along its banks, reaches a prodigious length from eaſt to weſt in a kind of amphitheatre towards the north, and is continued for near 20 miles on all ſides, in a ſucceſſion of magnificent villas and populous villages, the country-ſeats of gentlemen and tradeſmen; whither the latter retire for the benefit of freſh air, and to relax their minds, from the hurry of buſineſs. The regard paid by the legiſlature to the property of the ſubject, has hitherto prevented any bounds being fixed for its extenſion.

162 Its great extent, The irregular form of London makes it difficult to aſcertain its extent. However, its length from eaſt to weſt is generally allowed to be above ſeven miles from Hyde-park corner to Poplar; and its breadth in ſome places three, in others two, and in others again not much above half a mile. Hence the circumference of the whole is almoſt 18 miles; or according to a later meaſurement, the extent of continued buildings is 35 miles two furlongs and 39 roods. But it is much eaſier to form an idea of the large extent of the city ſo irregularly built by the number of the people who are computed to be near a million: and from the number of edifices devoted to the ſervice of religion.

163 General enumeration of churches, chaples,&c. Of theſe, beſide St Paul's cathedral and the collegiate church at Weſtminſter, here are 102 pariſh-churches, and 69 chapels, of the eſtabliſhed religion: 21 French proteſtant chapels; 11 chapels belonging to the Germans, Dutch, Danes, &c.; 26 independent meetings; 34 preſbyterian meetings; 20 baptiſt meetings: 19 popiſh chapels and meeting-houſes for the uſe of foreign ambaſſadors and people of various ſects; and three Jews ſynagogues. So that there are 305 places devoted to religious worſhip in the compaſs of this vaſt pile of buildings, without reckoning the 21 out-pariſhes uſually included in the bills of mortality, and a great number of methodiſt tabernacles.

164 Hoſpitals, ſchools, houſes, &. There are alſo in and near this city 100 alms-houſes, about 20 hoſpitals and infirmaries, 3 colleges, 10 public priſons, 15 fleſh markets; one market for live cattle; two other markets more particularly for herbs; and 23 other markets for corn, coals, hay, &c.; 15 inns of court, 27 public ſquares, beſides thoſe within ſingle buildings, as the Temple, &c.; 3 bridges, 55 halls for companies, 8 public ſchools, called free-ſchools; and 131 charity-ſchools, which provide education for 5034 poor children; 207 inns, 447 taverns, 551 coffeehouſes, 5975 alehouſes; 1000 hackney-coaches; 400 ditto chairs; 7000 ſtreets, lanes, courts, and alleys, and 150,000 dwelling-houſes, containing, as has been already obſerved, about 1,000,000 inhabitants;

165 Number of inhabitants

who, according to a moderate eſtimate, are ſuppoſed to conſume the following proviſions weekly:

166 Weekly conſumpt of proviſions.

	L.	s.	d
1000 Bullocks, at 6l. a-piece	6000	0	0
6000 Sheep, at 12 s. a-piece	3600	0	0
2000 Calves, at 1l. 4s. a-piece	2400	0	0
3000 Lambs, at 8 s. a-piece, for ſix months	1200	0	0
1500 Hogs in pork and bacon, at 20s. for ſix months	1500	0	0
2000 Pigs, at 2s. 6d. a-piece	250	0	0
1000 Turkies, at 3s. 6d. a-piece, for ſix months	175	0	0
1000 Geeſe, at 2s. 6d. a-piece, for ſix months	125	0	0
2000 Capons, at 1s. 8d. a piece	166	13	2
500 Dozens of Chickens at 9 s. *per* dozen	225	0	0
4300 Ducks, at 9d. a-piece	161	5	0
1500 Dozen of rabbits, at 7 s. *per* dozen, for eight months	525	0	0
2000 Dozen of pigeons, at 2s. *per* dozen, for eight months	200	00	0
700 Dozen of wild-fowl, of ſeveral ſorts, for ſix months	250	0	0
In ſalt and freſh fiſh, at 1 d. a-day, for half a million of people for one week	14,583	6	8
In bread of all ſorts, white and brown at 1 d. a-day, for one million of people for a week	29,166	13	4
300 Tons of wine, of all ſorts, at 50 l. a ton, one ſort with another, for one week	15,000	0	0
In milk, butter, cheeſe, &c, at 1 d. a-day, for a million of people for a week	29,166	13	4
In fruit of all ſorts, at one farthing a-day, for a million of people for a week	7291	13	4
In eggs of hens, ducks, geeſe, &c. at half a farthing a-day, for a million of people for a week	3645	16	8
In beer and ale, ſtrong and ſmall, at 2 d. a-day, for a million of people for a week	58,333	6	8
In ſugar, plums, and ſpice, and all ſorts of grocery, at a halfpenny a-day, for a million of people for a week	14,583	6	8
In wheat-flour, for pies and puddings, oatmeal and rice, &c. at half a farthing a-day, for a million of people for a week	3645	16	8
In ſalt, oil, vinegar, capers, olives, and other ſauces, at half a farthing a-day, for a million of people for a week	3645	16	8
In roots and herbs of all ſorts, both for food and phyſic, at half a farthing a-day, for a million of people for a week	3645	16	8
In ſea-coal, charcoal, candles, and firewood, of all ſorts, at 1 d. a-day, for a million of people for a week	29,166	13	4

In paper of all ſorts (a great quantity being uſed in printing) quills, pens, ink, and wax, at a farthing a-day, for a million of people for a week	7291	13	4
In tobacco, pipes, and ſnuff, at half a farthing a-day, for a million of people for a week - - -	3645	16	8
In cloathing, as linen and woollen, for men, women, and children; ſhoes, ſtockings, &c. at 3s. 6d. *per* week, for a million of people for a week - - -	175,000	0	0
Expences for horſe-meat, in hay, oats, beans, 1000 load of hay a-week, at 40s. a load, comes to 2000l. in oats and beans the like value, 2000l. which is in all, for one week	4000	0	0
Cyder, mum, brandy, ſtrong waters, coffee, chocolate, tea, &c. at 1 d. a day, for a million of people for one week - - - - - -	29,166	13	4

167 Firing, porter, &c. The common firing is pit-coal, commonly called *ſea-coal*, of which there are conſumed upwards of 766,880 chaldrons every year. The annual conſumption of oil in London and Weſtminiſter for lamps, amounts to 400,000l. In 1787, the quantity of porter brewed in London for home-conſumption and foreign exportation, amounted to 1,176,856 barrels.

168 Supply of water. This great and populous city is happily ſupplied with abundance of freſh water from the Thames and the New River; which is not only of inconceivable ſervice to every family, but by means of fire plugs every where diſperſed, the keys of which are depoſited with the pariſh officers, the city is in a great meaſure ſecured from the ſpreading of fire; for theſe plugs are no ſooner opened, than there are vaſt quantities of water to ſupply the engines. The plenty of water has been attended with another advantage, it has given riſe to ſeveral companies, who inſure houſes and goods from fire: another advantage that was not to be met with in any other nation on earth: the premium is ſmall, and the recovery in caſe of loſs is eaſy and certain. Every one of theſe offices keep a ſet of men in pay, who are ready at all hours to give their aſſiſtance in caſe of fire; and who are on all occaſions extremely bold, dexterous, and diligent; but though all their labours ſhould prove unſuceſsful, the perſon who ſuffers by this devouring element has the comfort that muſt ariſe from a certainty of being paid the value (upon oath) of what he has inſured

169 Inſurance companies.

170 Places of diverſion, &c. The places for diverſion are, Vauxhall, Ranelagh-gardens, the two play-houſes, one of them rebuilding, the Pantheon lately burnt down; and the little theatre in the Hay-market, with Saddlers wells, Hughe's Circus, and Aſtley's Royal-Grove, &c. The fineſt repoſitories of rarities and natural hiſtory, are Sir Hans Sloane's, in the Britiſh muſeum, already deſcribed; and another collected by the late Sir Aſhton Lever, now the private property of Mr Parkinſon, and depoſited in proper apartments for public inſpection, near the ſouth end of Blackfriars bridge.

LONDONDERRY, or COLERAIN, a county of Ireland, in the province of Ulſter. It is bounded on the ſouth and ſouth-weſt by the county of Tyronne; by Antrim on the eaſt, from which it is parted by the river Bann; by Donegal on the weſt; and that county and the Deucaledonian ocean on the north. Its greateſt length is about 36 miles, its breadth 30, containing about 251,510 acres. The bogs and heaths of this county are manured with ſea-ſhells, as thoſe of Donegal. Like that, too, it is pretty champaign and not unfruitful. It is particularly noted for a very clear river called the *Bann*, abounding with ſalmon, a fiſh ſaid to delight in limpid ſtreams. This river to diſtinguiſh it from a leſſer of the ſame name, is called the *Greater* or *Lower Bann*. In order to cultivate, ſettle and civilize this county, king James I. granted it, by letters patent, to a ſociety, by the name of the *Governor and aſſiſtants at London of the new plantation of Ulſter in the realm of Ireland*. It contains ſix baronies; and, beſides the two knights of the ſhire, ſends to parliament two members for the city of Londonderry, and two each for Coleraine and Newton-Limavady or Lamnevady.

LONDONDERRY, or *Derry*, the capital of the county, and the ſee of a biſhop, ſtands at the bottom of Lough-Foyle. This city has a very good port, to which ſhips of the greateſt burden have acceſs, and a conſiderable trade. It will be ever famous for the gallantry and perſeverance with which it defended itſelf in three memorable ſieges, in defiance of the greateſt hardſhips and diſcouragements, namely, 1ſt, In 1641, when the rebels could not reduce it either by fraud or force. 2dly, In 1649, when it was beſieged by the Lord Ardes, and reduced almoſt to extremity by famine, till at laſt relieved by troops ſent from England. 3dly, When it held out againſt the French and Iriſh from the 7th of December 1688 to the laſt day of July 1689, though it was neither well fortified nor provided with a garriſon or ſtores of proviſion and amunition, and hardly any attempt made to relieve it during ſo long a time. Though the city is 20 miles up the river, yet very large ſhips can come up to the quay, where there are four or five fathoms of water. It is now well fortified with a ſtrong wall, beſides outworks: and along the banks of the river are ſeveral caſtles and a fort. This city is of no great antiquity having been built and planted in the reign of James I. by a colony ſent by the ſociety abovementioned. The Trade of the town is very conſiderable, having not only a large ſhare in the herring fiſhery, but ſending ſhips alſo to the Weſt-Indies, New-England, and Newfoundland, for which they are ſo advantageouſly ſituated, that a veſſel bound from thence to America often arrives there before a London ſhip can get clear of the ſoundings, or arrive in the latitude of Londonderry. Tho' there are a great many ſhallows in Lough-Foyle, which ſerve it inſtead of a road; yet they are eaſily avoided, as there are deep channels between them. Theſe points called *Emiſtone*, *Ruſterhull*, or *Caldy-head* which lie a little to the weſt of the mouth of the harbour are counted the moſt northerly of Ireland, lying in lat. 55. 20. The inhabitants of this city are almoſt all Proteſtants. It gave title of *earl* and *baron* to a branch of the family of Pitt, which became extinct in 1764; but part of the title was revived in Robert Stewart, who was created Baron Londonderry in 1789. A late traveller ſays, " Derry is, perhaps,

haps, the cleaneſt, beſt built, and moſt beautiful ſituated town in Ireland; and, excepting Corke, as convenient as any for commerce, foreign and domeſtic." The lake almoſt ſurrounds it; and the whole ground-plot both of it and its liberties belongs to the 12 great companies of London. Great quantities of ſalmon, ſalted and barrelled, are exported from hence to America.

LONG, an epithet given to whatever exceeds the uſual ſtandard of length.

Long boat, the largeſt and ſtrongeſt boat belonging to any ſhip. It is principally employed to carry great burdens, as anchors, cables, ballaſt, &c. See Boat.

LONG (Roger), D. D. maſter of Pembroke-hall in Cambridge, Lowndes's profeſſor of aſtronomy in that univerſity, rector of Cherryhinton in Huntingdonſhire and of Bradwell *juxta mare* in Eſſex, was author of a well known and much approved treatiſe of aſtronomy and the inventor of a remarkably curious aſtronomical machine, thus deſcribed by himſelf, "I have, in a room lately built in Pembroke-hall, erected a ſphere of 18 feet diameter, wherein above 30 perſons may ſit conveniently; the entrance into it is over the ſouth pole by ſix ſteps; the frame of the ſphere conſiſts of a number of iron meridians, not complete ſemicircles, the northern ends of which are ſcrewed to a large round plate of braſs, with an hole in the centre of it; thro' this hole, from a beam in the cieling, comes the north pole, a round iron rod, about three inches long, and ſupports the upper parts of the ſphere to its proper elevation for the latitude of Cambridge; the lower part of the ſphere, ſo much of it as is inviſible in England, is cut off; and the lower or ſouthern ends of the meridians, or truncated ſemicircles, terminate on, and are ſcrewed down to, a ſtrong circle of oak, of about 13 feet diameter; which, when the ſphere is put into motion, runs upon large rollers of lignum vitæ in the manner that the tops of ſome windmills are made to turn round. Upon the iron meridians is fixed a zodiac of tin painted blue, whereon the ecliptic and heliocentric orbits of the planets are drawn, and the conſtellations and ſtars traced; the Great and Little Bear and Draco are already painted in their places round the north pole; the reſt of the conſtellations are propoſed to follow; the whole is turned round with a ſmall winch, with as little labour as it takes to wind up a jack, though the weight of the iron, tin, and wooden circle, is about 1000 pounds. When it is made uſe of, a planetarium will be placed in the middle thereof. The whole, with the floor, is well ſupported by a frame of large timber." Thus far Dr Long, before this curious piece of mechaniſm was perfected. Since the above was written, the ſphere has been completely finiſhed; all the conſtellations and ſtars of the northern hemiſphere, viſible at Cambridge, are painted in their proper places upon plates of iron joined together, which form one concave ſurface. Dr Long publiſhed a Commencement Sermon 1748; and an anſwer to Dr Galley's pamphlet on Greek Accents; and died December 16th 1770, at the age of 91. As the materials for this article are ſcanty, we ſhall ſubjoin, from the Gentleman's Magazine †, a few traits of him, as delineated in 1769 by Mr Jones. "He is now in the 88th year of his age, and for his years vigorous and active. He was lately (in October) put in nomination for the office of vice-chancellor. He executed that truſt once before, I think in the year 1737; a very ingenious perſon, and ſometimes very facetious. At the public commencement in the year 1713, Dr Greene (maſter of Bennet-college, and afterwards biſhop of Ely) being then vice-chancellor, Mr Long was pitched upon for the tripos-performance; it was witty and humorous, and has paſſed through divers editions. Some that remembered the delivery of it, told me, that in addreſſing the vice-chancellor (whom the univerſity wags uſually ſtyled *Miſs Greene*), the tripos orator, being a native of Norfolk, and aſſuming the Norfolk dialect, inſtead of ſaying *Domine Vice-Cancellarie*, did very archly pronounce the words thus, *Domina Vice-Cancellaria*; which occaſioned a general ſmile in that great auditory. His friend the late Mr Bonfoy of Ripton told me this little incident, 'That he and Dr Long walking together in Cambridge in a duſky evening, and coming to a ſhort *poſt* fixed in the pavement, which Mr B. in the midſt of chat and inattention, took to be a *boy* ſtanding in his way, he ſaid in a hurry, 'Get out of my way, boy.' '*That boy, Sir*,' ſaid the Doctor very calmly and ſlily, *is a* poſt-boy, *who turns out of his way for nobody*.— I could recollect ſeveral other ingenious repartees if there were occaſion. One thing is remarkable, he never was a hale and hearty man, always of a tender and delicate conſtitution, yet took great care of it. His common drink water; he always dines with the fellows in the hall. Of late years he has left off eating fleſh-meats; in the room thereof, puddings, vegetables, &c. ſometimes a glaſs or two of wine."

LONGEVITY, length of life.

From the different longevities of men in the beginning of the world, after the flood, and in theſe ages, Mr Derham draws an argument for the interpoſition of a divine Providence.

Immediately after the creation, when the world was to be peopled by one man and one woman, the ordinary age was 900 and upwards.—Immediately after the flood, when there were three perſons to ſtock the world, their age was cut ſhorter, and none of thoſe patriarchs but Shem, arrived at 500. In the ſecond century we find none that reached 240: in the third, none but Terah that came to 200 years; the world, at leaſt a part of it, by that time being ſo well peopled, that they had built cities, and were cantoned out into diſtant nations.—By degrees, as the number of peopled increaſed, their *longevity* dwindled, till it came down at length to 70 or 80 years: and there it ſtood, and has continued to ſtand ever ſince the time of Moſes.—This is found a good medium, and by means hereof the world is neither overſtocked, nor kept too thin; but life and death keep a pretty equal pace.

That the common duration of man's life has been the ſame in all ages ſince the above period, is plain both from ſacred and profane hiſtory. To paſs by others, Plato lived to 81, and was acounted an old man: and the inſtances of *longevity* produced by Pliny L. vii. c. 48. as very extraordinary, may moſt of them be matched in modern hiſtories.—In the following Tables are collected into one point of view the moſt memorable inſtances of long-lived perſons of whoſe age we

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† For 1783, p. 983.

Longevity. we have any authentic records.. The 1ſt and 2nd are extracted from *Mr Whitehurſt's Inquiry into the Origin and State of Earth*, with ſome additions by Dr Fothergill; who inſerted them, accompanied by a 3d, together with a number of uſeful obſervations, in the firſt volume of the Memoirs of the Mancheſter Literary Society,

Names of perſons.	Ages.	Places of Abode.	Living or Dead.
Thomas Parre	152	Shropſhire	Died November 16. 1635. Phil. Tranſ. N° 44.
Henry Jenkins	169	Yorkſhire	Died December 8, 1670. Phil. Tranſ. N° 221.
Robert Montgomery	126	Ditto	Died in — — 1670.
James Sands	140	Staffordſhire	Do Fuller's Worthies p. 47[illegible]
His wife	120	Ditto	
Counteſs of Deſmond	140	Ireland	Raleigh's Hiſt. p. 166.
———Ecleſton	143	Ditto	Died — — 1691. (A)
J. Sagar	112	Lancaſhire	—— — — 1668. (B)
—Laurence	140	Scotland	Living — — (C)
Simon Sack	141	Trionia	Died May 30. 1764.
Col. Thomas Winſlow	146	Ireland	—— Aug. 26. 1766.
Francis Conſiſt	150	Yorkſhire	—— Jan. — 1768.
Chriſt. J. Drakenberg	146	Norway	—— June 24. 1770. (D)
Margaret Forſter	136	Cumberland	Both living 1771.
———her daughter	104	Ditto	
Francis Bons	121	France	Died Feb. 6. 1769.
John Brookey	134	Devonſhire	Living — — 1777. (E)
James Bowels	152	Killingworth	Died Aug. 15. 1656. (F)
John Tice	125	Worceſterſhire	—— March 1774. (G)
John Mount	136	Scotland	—— Feb. 27. 1766. (H)
A. Goldſmith	140	France	—— June — 1776. (I)
Mary Yates	128	Shropſhire	—— — — 1776. (K)
John Bales	126	Northampton	—— April 5. 1766. (L)
William Ellis	130	Liverpool	—— Aug. 16. 1780. (M)
Louiſa Truxo, a Negreſs	175	Tucomea, S. America	Living Oct. 5. 1780. (N)
Magaret Patten	138	Lockneugh near Paiſley	Lynche's Guide to Health
Janet Taylor	108	Fintray, Scotland	Died Oct. 10. 1780.
Richard Lloyd	133	Montgomery	Lynche's Guide to Health
Suſannah Hilliar	100	Piddington, Northampſh.	Died Feb. 19. 1781. (O)
Ann Cockbolt	105	Stoke-Bruerne, *Ib.*	—— April 5. 1775. (P)
James Hayley	112	Middlewich, Cheſhire	—— March 17. 1781. (Q)

William Walker, aged 112, not mentioned above, who was a ſoldier at the battle of Edge-hill.

If we look back to an early period of the Chriſtian æra, we ſhall find that Italy has been, at leaſt about that time, peculiarly propitious to longevity. Lord Bacon obſerves that the year of our Lord 76, in the reign of Veſpaſian, was memorable; for in that year was a taxing which afforded the moſt authentic method of knowing the ages of men. From it, there were found in that part of Italy lying between the Appennine mountains and the river Po 124 perſons who either equalled or exceeded 100 years of age, namely:

54 perſons of 100 years each.
57 - - 110
2 - - 125

	4 perſons of	130 Years
	4 - -	136
	3 - -	140
In Parma	3 - -	120
	2 - -	130
In Bruſſels	1 - -	125
In Placentia	1 - -	131
In Faventia	1 - -	132
	6 - -	110
	4 - -	120
In Rimino	1 - -	150 Years, *viz.* Marcus Aponicus.

Mr

(A) Fuller's Worthies, p. 140.
(B) Phil. Tranſ. abridged by Lowthorp, Vol. VIII. p. 30, 6.
(C) Derham's Phyſico-Theology, p. 173.
(D) Annual Regiſter.
(E) Daily Advertiſer, Nov. 18. 1777.
(F) Warwickſhire.
(G) Daily Advertiſer, March 1774.
(H) Morning Poſt, Feb. 29. 1776.
(I) Daily Advertiſer, June 24. 1776.
(K) Daily Advertiſer, Aug. 22. 1776.
(L) See Inſcription in the portico of All-Saints-church.
(M) London Even. Poſt. Aug 22. 1780.
(N) London Chronicle, Oct. 5. 1780.
(O) Northamp. Mercury, Feb. 19. 1781.
(P) Well known to perſons of credit of Northampton.
(Q) Gen. Evening Poſt, March 24. 1781.

Mr Carew, in his ſurvey of Cornwall, aſſures us, that it is no unuſual thing with the inhabitants of that county to reach 90 years of age and upwards, and even to retain their ſtrength of body and perfect uſe of their ſenſes. Beſides Brown, the Corniſh beggar, who lived to 120, and one Polezew to 130 years of age, he remembered the deceaſe of four perſons in his own pariſh, the ſum of whoſe years, taken collectively, amounted to 340. Now, although longevity evidently prevails more in certain diſtricts than in others, yet it is by no means confined to any particular nation or climate; nor are there wanting inſtances of it, in almoſt every quarter of the globe, as appears from the preceding as well as the ſubſequent Tables; which might have been conſiderably enlarged, had it appeared neceſſary; but we have only added, in the laſt, three recent inſtances that are peculiarly remarkable.

Names of the Perſons.	Age.	Places of Abode.	Where recorded.
Hippocrates, Phyſician	104	Iſland of Cos	Lynche on Health, chap. 3.
Democritus, Philoſopher	105	Abdera	Bacon's Hiſtory, 1095.
Galen, Phyſician	140	Pergamus	Voſſ. Inſt. or lib. 3.
Albuna, Marc	150	Ethiopia	Hakewell's Ap. lib. 1.
Dumitur Raduly	140	Haromlzeck, Tranſylvania	Died Jan. 8, 1782. Gen. Gazetteer, April 18th.
Titus Fullonius	150	Bononia	Fulgoſus, lib. 8.
Abraham Paiba	142	Charleſtown, South-Ca.	General Gazetteer
L. Tertulla	137	Arminium	Bulgoſus lib. 8.
Lewis Cornaro	100	Venice	Bacon's Hiſt. of Life, p. 134.
Robert Blakeney, Eſq.	114	Armagh, Ireland	General Gazetteer.
Margaret Scott	125	Dalkeith, Scotland	Inſcrip. on her Tomb there.
W. Gulſtone	140	Ireland	Fuller's Worthies.
J. Bright	105	Ludlow	Lynche on Health.
William Poſtell	120	France	Bacon's Hiſtory, p. 134.
Jane Reeves	103	Eſſex	St J. Chron. June 14. 1781.
W. Paulet, Marquis of Wincheſter	106	Hampſhire	Baker's Chron. p. 502.
John Wilſon	116	Suffolk	Gen. Gaz. Oct. 29. 1782.
Patrick Wian	115	Leſbury, Northumber^{d}.	Plemp. Fundammed, § 4. c. 8.
M. Laurance	140	Orcades	Buchanan's Hiſt. of Scot.
Evan Williams	145	Caermarthen workhouſe, ſtill alive	Gen. Gazetteer, Oct. 12. 1782.
John Jacobs (R)	121	Mount Jura	All the public prints, Jan. 1790.
Matthew Tait (S)	123	Auchinleck, Airſhire.	Died Feb. 19. 1792. Edin. Even. Cour. Mar. 8. 1792.
Donald Macleod (T)	104	Iſle of Sky. Alive Jan. 1792	All the public prints at the end of 1790; and *Memoirs*, &c.

(R) This man, in 1789, at the age of 120, quitted his native hills, and from the ſummit of Mount Jura undertook a journey to Verſailles, to be hold and return thanks to the National Aſſembly for the vote which had freed him and his poor countrymen from the feudal yoke. In the early part of his life, he was a ſervant in the family of the prince de Beaufremont. His memory continued good to the laſt day of his life; and the principal inconveniences which he felt from his great age were, that his ſight was weakened, and the natural heat of his body was ſo diminiſhed, that he ſhivered with cold in the middle of the dog-days if he was not ſitting by a good fire. This old man was received in the body of the houſe by the National Aſſembly, indulged with a chair, and directed to keep on his hat leſt he ſhould catch cold if he was to ſit uncovered. A collection was made for him by the members, which exceeded 500 l. Sterling; but he lived not to return to Mount Jura. He was buried on Saturday the 31ſt of January 1790, with great funeral pomp, in the pariſh-church of St Euſtace at Paris.

(S) He ſerved as a private at the taking of Gibraltar in 1704.

(T) *Memoirs of the Life and gallant Exploits of the Old Highlander Serjeant Donald Macleod*, &c. publiſhed Jan. 1791, in the 103d year of his age.—This old gentleman, for it appears that he really is a gentleman both by birth and by behaviour, was born in the year of the Revolution, in the pariſh of Bracadill, in the iſle of Sky and county of Inverneſs, North Britain. He is a cadet of the family of Uliniſh in Sky; and deſcended, through his mother, from Macdonald of Slate, the anceſtor of the preſent Lord Macdonald. The earlier part of his life coincided with the famine of ſeven years in Scotland; which was ſo great as to ſuggeſt, even to the patriotic Mr Fletcher, the idea of the people ſelling themſelves as ſlaves for immediate ſubſiſtence. He was bred in the midſt of want and hardſhips, cold, hunger, and for the years of his apprenticeſhip with a maſon and ſtone-cutter in Inverneſs, in inceſſant fatigue. He enliſted, when a boy, in the Scottiſh ſervice, in the town of Perth, in the laſt year of the reign of King William. The regiment into which he enliſted

The Antediluvians are purpoſely omitted, as bearing too little reference to the preſent race of mortals, to afford any ſatisfactory concluſions; and as they have been already taken notice of in a ſeparate article; (ſee ANTEDILUVIANS). As the improbable ſtories of ſome perſons who have almoſt rivalled them in modern times, border too much upon the marvellous to find a place in theſe tables, the preſent examples are abundantly ſufficient to prove, that longevity does not depend, ſo much, as has been ſuppoſed, on any particular climate, ſituation, or occupation in life: for we ſee, that it often prevails in places where all theſe are extremely diſſimilar; and it would, moreover, be very difficult, in the hiſtories of the ſeveral perſons abovementioned, to find any circumſtance common to them all, except, perhaps, that of being born of healthy parents, and of being inured to daily labour, temperance, and ſimplicity of diet. Among the inferior ranks of mankind, therefore, rather than among the ſons of eaſe and luxury, ſhall we find the moſt numerous inſtances of longevity; even frequently, when other external circumſtances ſeem extremely unfavourable: as in the caſe of the poor ſexton at Peterborough, who, notwithſtanding his unpromiſing occupation among dead bodies, lived long enough to bury two crowned heads, and to ſurvive two complete generations. The livelihood of Henry Jenkins and old Parre, is ſaid to have conſiſted chiefly of the coarſeſt fare, as they depended on precarious alms. To which may be added the remarkable inſtance of Agnes Milbourne, who, after bringing forth a numerous offſpring, and being obliged, through extreme indigence, to paſs the latter part of her life in St Luke's workhouſe, yet reached her 106th year in that ſordid and unfriendly ſituation. The plain diet and invigorating employments of country life are acknowledged on all hands to be highly conducive to health and longevity, while the luxury and refinements of large cities are allowed to be equally deſtructive to the human ſpecies; and this conſideration alone, perhaps, more than counterbalances all the boaſted privileges of ſuperior elegance and civilization reſulting from a city life.

From country villages, and not from crowded cities, have the preceding inſtances of longevity been chiefly ſupplied. Accordingly it appears, from the London bills of mortality, during a period of 30 years, viz. from the year 1728 to 1758, the ſum of the deaths amounted to 750,322, and that, in all this prodigious number, only 242 perſons ſurvived the 100th year of their age! This overgrown metropolis is computed by Dr Price to contain a ninth part of the inhabitants of England, and to conſume annually 7000 perſons, who remove into it from the country every year, without increaſing it. He moreover obſerves, that the number of inhabitants in England and Wales has diminiſhed about one fourth part ſince the Revolution; and ſo rapidly of late, that in 11 years, near 200,000 of the common people have been loſt. If the calculation be juſt, however alarming it may appear in a national view, there is this conſolation, when conſidered in a philoſophical light, that without partial evil, there can be no general good; and that what a nation loſes in the ſcale of population at one period, it gains at another; and thus probably, the average number of inhabitants on the ſurface of the globe continues at all times nearly the ſame. By this medium, the world is neither overſtocked with inhabitants nor kept too thin, but life and death keep a tolerably equal pace. The inhabitants of Britain comparatively ſpeaking, are but as the duſt of the balance; yet inſtead of being diminiſhed, we are aſſured by other writers, that within theſe 30 years they are greatly increaſed.

The deſire of ſelf-preſervation, and of protracting the ſhort ſpan of life, is ſo intimately interwoven with our conſtitution, that it is juſtly eſteemed one of the firſt principles of our nature, and, in ſpite even of pain and miſery, ſeldom quits us to the laſt moments of our exiſtence. It ſeems, therefore, to be no leſs our duty than our intereſt, to examine minutely into the various

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was the Scots Royals, commanded by the earl of Orkney. That old military corps, at that time, uſed bows and arrows as well as ſwords, and wore ſteel caps. He ſerved in Germany and Flanders under the duke of Marlborough, under the duke of Argyle in the rebellion 1715, in the Highland Watch, or companies raiſed for enforcing the laws in the Highlands; in the ſame companies when, under the name of the 42d regiment, they were ſent abroad to Flanders, to join the army under the duke of Cumberland; in the ſame regiment in Ireland, and on the breaking out of the French war, 1757, in America. From the 42d he was draughted to act as a drill ſerjeant in the 78th regiment, in which he ſerved at the reduction of Louiſburg and Quebec: After this he became an out-penſioner of Chelſea Hoſpital. But ſuch was the ſpirit of this brave and hardy veteran, that he ſerved in 1761 as a volunteer in Germany under the marquis of Granby; and offered his ſervices in the American war to Sir Henry Clinton; who, though he declined to employ the old man in the fatigues and dangers of war, treated him with great kindneſs, allowed him a liberal weekly penſion out of his own pocket, and ſent him home in a ſhip charged with diſpatches to government.—The ſerjeant, “as his memory, according to the obſervation of his biographer, is impaired, does not pretend to make an exact enumeration of all his offſpring: but he knows of 16 ſons now living, 14 of whom are in the army and navy, beſides daughters: the eldeſt of whom by his preſent wife is a mantuamaker in Newcaſtle.—His eldeſt ſon is now 83 years old, and the youngeſt only nine. Nor, in all probability, would this lad cloſe the rear of his immediate progeny, if his preſent wife, the boy's mother, had not attained to the 49th year of her age.”—In his prime, he did not exceed five feet and ſeven inches. He is now inclined through age to five feet five inches. He has an intereſting phyſiognomy expreſſive of ſincerity, ſenſibility, and manly courage. His biographer very properly ſubmits it to the conſideration of the Polygraphic Society, whether they might not do a thing worthy of themſelves and their ingenious art, if they ſhould multiply likeneſſes of this living antiquity, and circulate them at an eaſy rate throughout Britain and Europe. They would thus gratify a very general curioſity; a curioſity not confined to the preſent age.

various means that have been conſidered as conducive to health and long life; and, if poſſible to diſtinguiſh ſuch circumſtances as are eſſential to that great end from thoſe which are merely accidental. But here it is much to be regretted, that an accurate hiſtory of the lives of all the remarkable perſons in the above table, ſo far as relates to the diet, regimen, and the uſe of the non naturals, has not been faithfully handed down to us; without which it is impoſſible to draw the neceſſary inferences. Is it not then a matter of aſtoniſhment, that hiſtorians and philoſophers have hitherto paid ſo little attention to longevity? If the preſent imperfect liſt ſhould excite others, of more leiſure and better abilities, to undertake a full inveſtigation of ſo intereſting a ſubject, the inquiry might prove not only curious but highly uſeful to mankind. In order to furniſh materials for a future hiſtory of longevity, the bills of mortality throughout the kingdom ought firſt to be reviſed, and put on better footing agreeable to ſcheme of which Mancheſter and Cheſter have already given a ſpecimen highly worthy of imitation. The plan, however, might be further improved with very little trouble, by adding a particular account of the diet and regimen of every perſon who dies at 80 years of age or upwards; and mentioning whether his parents were healthy, long-lived poeple, &c. An accurate regiſter, thus eſtabliſhed throughout the Britiſh dominions would be productive of many important advantages to ſociety, not only in a medical and philoſophical, but alſo in a political and moral view.

All the circumſtances that are moſt eſſentially neceſſary to life, may be compriſed under the ſix following heads: 1. Air and climate; 2. Meat and drink; 3. Motion and reſt; 4. The ſecretions and excretions; 5. Sleep and watching; 6. Affections of the mind.

Theſe, though all perfectly natural to the conſtitution, have by writers been ſtyled the non-naturals, by a ſtrange perverſion of language; and have been all copiouſly handled under that improper term. However, it may not be amiſs to offer a few ſhort obſervations on each, as they are ſo immediately connected with the preſent ſubject.

1. *Air*, &c. It has long been known that freſh air is more immediately neceſſary to life than food; for a man may live two or three days without the latter, but not many minutes without the former. The vivifying principle contained in the atmoſphere, ſo eſſential to the ſupport of flame, as well as animal life, concerning which authors have propoſed ſo many conjectures, appears now to be nothing elſe but that pure dephlogiſticated fluid lately diſcovered by that ingenious philoſopher Dr Prieſtley. The common atmoſphere may well be ſuppoſed to be more or leſs healthy in proportion as it abounds with this animating principle. As this exhales in copious ſtreams from the green leaves of all kinds of vegetables, even from thoſe of the moſt poiſonous kind, may we not, in ſome meaſure, account why inſtances of longevity are ſo much more frequent in the country than in large cities where the air, inſtead of partaking ſo largely of this ſalutary impregnation, is daily contaminated with noxious animal effluvia, and phlogiſton?

With reſpect to climate, various obſervations, conſpire to prove, thoſe regions which lie within the temperate zones are beſt calculated to promote long life. Hence, perhaps, may be explained, why Italy has produced ſo many long livers; and why iſlands in general are more ſalutary than continents; of which Bermudas and ſome others afford examples. And it is a pleaſing circumſtance for Great Britain that ſhe appears from the above table (notwithſtanding the ſudden viciſſitudes to which it is liable) to contain far more inſtances of longevity than could well be imagined. The ingenious Mr Whitehurſt aſſures us from certain facts, that Engliſhmen are in general longer lived than North Americans; and that a Britiſh conſtitution will laſt longer, even in that climate, than a native one. But it muſt be allowed in general, that the human conſtitution is adapted to the peculiar ſtate and temperature of each reſpective climate, ſo that no part of the habitable globe can be pronounced too hot or too cold for its inhabitants. Yet in order to promote a friendly intercourſe between the moſt remote regions, the Author of nature has wiſely enabled the inhabitants to endure great and ſurpriſing changes of temperature with impunity.

2. *Food and drink*. Though foods and drink of the moſt ſimple kinds are allowed to be the beſt calculated for ſupporting the body in health, yet it can hardly be doubted but variety may be ſafely indulged occaſionally, provided men would reſtrain their appetites within the bounds of temperance; for bountiful Nature cannot be ſuppoſed to have poured forth ſuch a rich profuſion of proviſions, merely to tantalize the human ſpecies, without attributing to her the part of a cruel ſtep-dame, inſtead of that of the kind and indulgent parent. Beſides, we find that by the wonderful powers of the digeſtive organs, a variety of animal and vegetable ſubſtances, of very diſcordant principles, are happily aſſimilated into one bland homogeneous chyle; therefore it ſeems natural to diſtruſt thoſe cynical writers, who would rigidly confine mankind to one ſimple diſh, and their drink to the mere water of the brook. Nature, it is true, has pointed out that mild inſipid fluid as the univerſal diluent, and therefore moſt admirably adapted for our daily beverage. But experience has equally proved, that vinous and ſpiritous liquors, on certain occaſions, are no leſs ſalutary and beneficial, whether it be to ſupport ſtrength againſt ſickneſs or bodily fatigue, or to exhilerate the mind under the preſſure of heavy misfortunes. But, alas! what Nature meant for innocent and uſeful cordials, to be uſed only occaſionally, and according to the direction of reaſon, cuſtom and caprice have, by degrees, rendered habitual to the human frame, and liable to the moſt enormous and deſtructive abuſes. Hence it may be juſtly doubted, whether gluttony and intemperance have not depopulated the world more than even the ſword, peſtilence and famine. True, therefore, is the old maxim, "*Modus utendi ex veneno facit medicamentum, ex medicamento venenum.*

3. and 4. *Motion and reſt, ſleep and watching.* It is allowed an all hands, that alternate motion and reſt, and ſleep and watching, are neceſſary conditions to health and longevity; and that they ought to be adapted to age, temperament, conſtitution, temperature of the climate, &c.; but the errors which mankind daily commit in thoſe reſpects become a fruitful ſource of diſeaſes. While ſome are bloated and relaxed with

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eaſe and indolence, others are emaciated, and become rigid through hard labour, watching and fatigue.

5. *Secretions and excretions.* Where the animal functions are duly performed, the ſecretions go on regularly; and the different evacuations ſo exactly correſpond to the quantity of aliment taken in, in a given time, that the body is found to return daily to nearly the ſame weight. If any particular evacuation happen to be preternaturally diminiſhed, ſome other evacuation is proportionally augmented, and the equilibrium is commonly preſerved: but continued irregularities, in theſe important functions, cannot but terminate in diſeaſe.

6. *Affections of the mind.* The due regulation of the paſſions, perhaps, contributes more to health and longevity than that of any other of the non-naturals. The animating paſſions, ſuch as joy, hope, love, &c. when kept within proper bounds, gently excite the nervous influence, promote an equable circulation, and are highly conducive to health: while the depreſſing affections, ſuch as fear, grief, and deſpair, produce the contrary effect, and lay the foundation of the moſt formidable diſeaſes.

From the light which hiſtory affords us, as well as from ſome inſtances in the above table, there is great reaſon to believe, that longevity is in a great meaſure hereditary; and that healthy long-lived parents would commonly tranſmit the ſame to their children, were it not for the frequent errors in the non-naturals, which ſo evidently tend to the abbreviation of human life.

Where is it, but from theſe cauſes, and the unnatural modes of living, that, of all the children which are born in the capital cities of Europe, nearly one half die in early infancy? To what elſe can we attribute this extraordinary mortality? Such an amazing proportion of premature deaths is a circumſtance unheard of among ſavage nations, or among the young of other animals! In the earlieſt ages, we are informed, that human life was protracted to a very extraordinary length; yet how few perſons, in theſe later times, arrive at that period which nature ſeems to have deſigned! Man is by nature a field animal, and ſeems deſtined to riſe with the ſun, and to ſpend a large portion of his time in the open air, to inure his body to robuſt exerciſes and the inclemency of the ſeaſons, and to make a plain homely repaſt only when hunger dictates. But art has ſtudiouſly defeated the kind intentions of nature; and by enſlaving him to all the blandiſhments of ſenſe, has left him, alas! an eaſy victim to folly and caprice. To enumerate the various abuſes which take place from the earlieſt infancy, and which are continued through the ſucceeding ſtages of modiſh life, would carry us far beyond our preſent intention. Suffice it to obſerve, that they prevail more particularly among people who are the moſt highly poliſhed and refined. To compare their artificial mode of life with that of nature, or even with the long-livers in the liſt, would probably afford a very ſtriking contraſt; and at the ſame time ſupply an additional reaſon why, in the very large cities, inſtances of longevity are ſo very rare.

LONGFORD, a county of Ireland, in the province of Leinſter, bounded by the country of Leitrim and Cavan on the north, Meath on the eaſt and ſouth, and Roſcommon on the weſt. It contains 134,700 Iriſh plantation acres, 24 pariſhes, 6 baronies, and 4 boroughs; and returns 10 members to parliament. It is ſmall and much encumbered with bog, intermixed with a tolerable good ſoil; and is about 25 miles long and 15 broad.

Longford, a town of Ireland, ſituated on the river Cromlin, in the county of Longford and province of Leinſter, 64 miles from Dublin; which river falls a few miles below this place into the Shannon. It is a borough, poſt, market, and fair town; and returns two members to parliament; patron Lord Longford. It gave title of *earl* to the family of Aungier; of *viſcount*, to the family of Micklethwaite; and now gives that of *baron* to the family of Packenham. Within a mile and a half of the town is a charter-ſchool for above 40 children. This place has a barrack for a troop of horſe. It is large and well built; and in a very early age an abbey was founded here, of which St Idus, one of St Patrick's diſciples, was abbot. In the year 1400, a fine monaſtery was founded to the honour of the Virgin Mary, for Dominican friars, by O'Ferral prince of Acally. This monaſtery being deſtroyed by fire, Pope Martin V. by a bull in the year 1429, granted an indulgence to all who ſhould contribute to the rebuilding of it. In 1433, Pope Eugene IV. granted a bull to the ſame purpoſe; and in 1438 he granted another to the like effect. The church of this friary, now the pariſh-church, is in the dioceſe of Ardagh. The fairs are four in the year.

LONG-ISLAND, is an iſland of North America belonging to the ſtate of New-York, which is ſeparated from the continent by a narrow channel. It extends from the city of New-York 140 miles, terminating with Montauk point; and is not more than 10 miles in breadth on a medium. It is divided into three counties, King's, Queen's, and Suffolk. The ſouth ſide of the iſland is flat land, of a light ſandy ſoil, bordered on the ſea-coaſt with large tracts of ſalt meadow, extending from the weſt point of the iſland to Southampton. This ſoil, however, is well calculated for raiſing grain, eſpecially Indian corn. The north ſide of the iſland is hilly, and of a ſtrong ſoil, adapted to the culture of grain, hay and fruit. A ridge of hills extends from Jamaica to South-hold. Large herds of cattle feed upon Hampſtead plain and on the ſalt marſhes upon the ſouth ſide of the iſland. Hampſtead plain in Queen's county is a curioſity. It is 16 miles in length, eaſt and weſt, and 7 or 8 miles wide. The ſoil is black, and to appearance rich, and yet it was never known to have any natural growth, but a kind of wild graſs and a few ſhrubs. It is frequented by vaſt numbers of plovers. Rye grows tolerably well on ſome parts of the plain. The moſt of it lies common for cattle, horſes and ſheep. As there is nothing to impede the proſpect in the whole length of this plain, it has a curious but tireſome effect upon the eye, not unlike that of the ocean. The iſland contains 30,863 inhabitants.

LONGIMETRY, the art of meaſuring lengths, both acceſſable and inacceſſile. See GEOMETRY and TRIGONOMERRY.

LONGING, is a preternatural appetite in pregnant women, and in ſome ſick perſons when about to recover. It is called *pica*, from the bird of that name, which is ſaid to be ſubject to the ſame diſorder. The diſorder conſiſts of both a deſire of unuſual things to eat and drink, and in being ſoon tired of one and wanting another. It is called *malacia*, from μαλακος, "weakneſs." In pregnant women it is ſomewhat relieved by bleeding, and in about the fourth month of their pregnancy it leaves them. Chlorotic girls, and men who labour under ſuppreſſed hæmorrhoids, are very ſubject to this complaint, and are relieved by promoting the reſpective evacuations. In general, whether this diſorder is obſerved in pregnant women, in perſons recovering from an acute fever, or in thoſe who labour under obſtructions of the natural evacuations, this craving of the appetite ſhould be indulged.

LONGINICO, a town of Turkey in Europe, in the Morea, anciently called *Olympia*, famous for being the place where the Olympic games were celebrated, and for the temple of Jupiter Olympus, about a mile diſtant. It is now but a ſmall place, ſeated on the river Alpheus, 10 miles from its mouth, and 50 ſouth of Lepanto. E. Long. 22. 0. N. Lat. 37. 30.

LONGINUS (Dionyſius), a celebrated Greek critic of the third century, was probably an Athenian. His father's name is unknown, but by his mother he was allied to the celebrated Plutarch. His youth was ſpent in travelling with his parents, which gave him an opportunity to increaſe his knowledge, and improve his mind. After his travels, he fixed his reſidence at Athens, and with the greateſt aſſiduity applied to ſtudy. Here he publiſhed his Treatiſe on the Sublime; which raiſed his reputation to ſuch a height, and gave the Athenians ſuch an opinion of his judgment and taſte, that they made him ſovereign judge of all authors, and every thing was received and rejected by the public according to his deciſions. He ſeems to have ſtaid at Athens a long time; here he taught the academic philoſophy, and among others had the famous Porphyry for his pupil. But it was at length his fortune to be drawn from Athens, and to mix in more active ſcenes; to train up young princes to virtue and glory; to guide the buſy paſſions of the great to noble objects; to ſtruggle for, and at laſt to die, in the cauſe of liberty. Zenobia, queen of the Eaſt, prevailed on him to undertake the education of her ſons; and he ſoon gained an uncommon ſhare in her eſteem: ſhe ſpent the vacant hours of her life in his converſation, and modelled her ſentiments and conduct by his inſtructions. That princeſs was at war with Aurelian; and being defeated by him near Antioch, was compelled to ſhut herſelf up in Palmyra, her capital city. The emperor wrote her a letter, in which he ordered her to ſurrender; to which ſhe returned an anſwer, drawn up by Longinus, which filled him with reſentment. The emperor laid ſiege to the city; and the Palmyrians were at length obliged to open their gates and receive the conqueror. The Queen and Longinus endeavoured to fly into Perſia; but were unhappily overtaken and made priſoners when they were on the point of croſſing the Euphrates. The Queen, intimidated, weakly laid the blame of vindicating the liberty of her country on its true author; and the brave Longinus, to the diſgrace of the conqueror, was carried away to immediate execution. The writings of Longinus were numerous, ſome on philoſophical, but the greater part on critical ſubjects. Dr Pearce has collected the titles of 25 treatiſes, none of which, excepting that on the Sublime, have eſcaped the depredations of time and barbarians. On this imperfect piece the great fame of Longinus is raiſed, who, as Pope expreſſes it—"is himſelf the great ſublime he draws." The beſt edition of his works is that by Tollius, printed at Utrecht in 1694, *cum notis variorum*. It has been tranſlated into Engliſh by Mr Smith.

LONGISSIMUS DORSI. See ANATOMY, *Table of the Muſcles*.

LONGITUDE, in geography and navigation, is the diſtance of any place from another eaſtward or weſtward, counted in degrees, upon the equator; but when the diſtance is reckoned by leagues or miles and not in degrees, or in degrees on the meridian, and not of the parallel of latitude, in which caſe it includes both latitude and longitude, it is called *departure*.

To find the longitude at ſea, is a problem to which the attention of navigators and mathematicians has been drawn ever ſince navigation began to be improved.—The importance of this problem ſoon became ſo well known, that, in 1598, Philip III. of Spain offered a reward of 1000 crowns for the ſolution; and his example was ſoon followed by the States General, who offered 10,000 florins. In 1714 an act was paſſed in the Britiſh parliament, impowering certain commiſſioners to make out a bill for a ſum not exceeding 2000 l. for defraying the neceſſary expences of experiments for aſcertaining this point; and likewiſe granting a reward to the perſon who made any progreſs in the ſolution, proportionable to the degree of accuracy with which the ſolution was performed: 10,000 l. was granted if the longitude ſhould be determined to one degree of a great circle, or 60 geographical miles; 15,000 if two thirds of that diſtance; and 20,000 if to the half the diſtance.

In conſequence of theſe proffered rewards, innumerable attempts were made to diſcover this important ſecret. The firſt was that of John Morin profeſſor of mathematics at Paris, who propoſed it to Cardinal Richelieu; and though it was judged inſufficient on account of the imperfection of the lunar tables, a penſion of 2000 livres *per annum* was procured for him in 1645 by Cardinal Mazarine. Gemma Friſius had indeed, in 1530, projected a method of finding the longitude by means of watches, which at that time were newly invented: but the ſtructure of theſe machines was then by far too imperfect to admit of any attempt; nor even in 1631, when Metius made an attempt to this purpoſe, were they advanced in any conſiderable degree. About the year 1664, Dr Hooke and Mr Huygens made a very great improvement in watchmaking, by the application of the pendulum ſpring. Dr Hooke having quarrelled with the miniſtry, no experiment was made with any of his machines; but many were made with thoſe of Mr Huygens. One experiment, particularly, made by Major Holmes, in a voyage from the Coaſt of Guinea in 1665, anſwered ſo well, that Mr Huygens was encouraged to improve the ſtructure of his watches; but it was found that the variations of heat and cold produced ſuch alterations in the rate of going of the watch, that unleſs this could be remedied, the watches could be of little uſe in determining the longitude.

In 1714 Henry Sully, an Engliſhman, printed a ſmall tract at Vienna upon the ſubject of watchmaking. Having afterwards removed to Paris, he applied himſelf to the improvement of time-keepers for the diſcovery of the longitude. He taught the famous Julian de Roy; and this gentleman, with his ſon, and M. Berthoud, are the only perſons who, ſince the days of Sully, have turned their thoughts this way. But though experiments have been made at ſea with ſome of their watches, it does not appear that they have been able to accompliſh any thing of importance with regard to the main point. The firſt who ſucceeded in any conſiderable degree was Mr John Harriſon; who, in 1726, produced a watch which went ſo exactly, that for ten years together it did not err above one ſecond in a month. In 1736 it was tried in a voyage to Liſbon and back again, on board a ſhip of his Britannic majeſty; during which it corrected an error of a degree and a half in the computation of the ſhip's reckoning. In conſequence of this he received public encouragement to go on; and by the year 1761 had finiſhed three time-keepers, each of them more accurate than the former. The laſt turned out ſo much to his ſatisfaction, that he now applied to the commiſſioners of longitude for leave to make an experiment with his watch in a voyage to the Weſt-Indies. Permiſſion being granted, his ſon Mr William Harriſon ſet out in a Britiſh ſhip the Deptford for Jamaica in the month of November 1761. This trial was attended with all imaginable ſucceſs. The longitude of the iſland, as determined by the time-keeper, differed from that found by aſtronomical obſervations only one minute and a quarter of the equator; the longitude of places ſeen by the way being alſo determined with great exactneſs. On the ſhip's return to England, it was found to have erred no more during the whole voyage than $1'\ 54\frac{1}{2}''$ in time, which is little more than 28 miles in diſtance; which being within the limits preſcribed by the Britiſh act, the inventor claimed the whole L.20,000 offered by government. Objections to this, however, were ſoon ſtarted. Doubts were pretended about the real longitude of Jamaica, as well as the manner in which the time had been found both there and at Portſmouth. It was alleged alſo, that though the time-keeper happened to be right at Jamaica, and after its return to England, this was by no means a proof that it had always been ſo in the intermediate times; in conſequence of which allegations, another trial was appointed in a voyage to Barbadoes. Precautions were now taken to obviate as many of theſe objections as poſſible. The commiſſioners ſent out proper perſons to make aſtronomical obſervations at that iſland; which, when compared with others in England, would aſcertain beyond a doubt its true ſituation. In 1764 then, Mr Harriſon junior ſet ſail for Barbadoes; and the reſult of the experiment was, that the difference of longitude betwixt Portſmouth and Barbadoes was ſhown by the time-keeper to be $3h.\ 55'\ 3''$; and by aſtronomical obſervations to be $3h.\ 54'\ 20''$; the error being now only $43''$ of time, or $10'\ 45''$ of longitude. In conſequence of this and the former trials, Mr Harriſon received one half of the reward promiſed, upon making a diſcovery of the principles upon which his time-keepers were conſtructed. He was likewiſe promiſed the other half of the reward as ſoon as time-keepers ſhould be conſtructed by other artiſts which ſhould anſwer the purpoſe as well as thoſe of Mr Harriſon himſelf. At this time he delivered up all his time-keepers, the laſt of which was ſent to Greenwich to be tried by Mr Nevil Maſkelyne the aſtronomer-royal. On trial, however, it was found to go with much leſs regularity than had been expected; but Mr Harriſon attributed this to his having made ſome experiments with it which he had not time to finiſh when he was ordered to deliver up the watch. Soon after this, an agreement was made by the commiſſioners with Mr Kendall to conſtruct a watch upon Mr Harriſon's principles; and this upon trial was found to anſwer the purpoſe even better than any that Harriſon himſelf had conſtructed. This watch was ſent out with captain Cook in 1772; and during all the time of his voyage round the world in 1772, 1773, 1774, and 1775, never erred quite $14\frac{1}{2}$ ſeconds per day: in conſequence of which, the houſe of commons, in 1774, ordered the other L.10,000 to be paid to Mr Harriſon. Still greater accuracy, however, has been attained. A watch was lately conſtructed by Mr Arnold, which, during a trial of 13 months, from February 1779 to February 1780, varied no more than $6.69''$ during any two days; and the greateſt difference between its rates of going on any day and the next to it was 4.11." The greateſt error it would have committed therefore in the longitude during any ſingle day would have been very little more than one minute of longitude; and thus might the longitude be determined with as great exactneſs as the latitude generally can. This watch, however, has not yet been tried at ſea.

Thus the method of conſtructing time-keepers for diſcovering the longitude ſeems to be brought to as great a degree of perfection as can well be expected. Still, however, as theſe watches are ſubject to accidents, and may thus alter the rate of their going without any poſſibility of a diſcovery, it is neceſſary that ſome other method ſhould be fallen upon, in order to correct from time to time thoſe errors which may ariſe either from the natural going of the watch, or from any accident which may happen to it. Methods of this kind are all founded upon celeſtial obſervations of ſome kind or other; and for theſe methods, or even for an improvement in time-keepers, rewards are ſtill held out by Great Britain. After the diſcoveries made by Mr Harriſon, the act concerning the longitude was repealed, excepting ſo much of it as related to the conſtructing, printing, publiſhing, &c. of nautical almanacks and other uſeful tables. It was enacted alſo that any perſon who ſhall diſcover a method for finding the longitude by means of a time-keeper, the principles of which have not hitherto been made public, ſhall be intitled to a reward of L. 5000, if, after certain trials made by the commiſſioners, the ſaid method ſhall enable a ſhip to keep her longitude during a voyage of ſix months within 60 geographical miles or a degree of a great circle. If the ſhip keeps longitude within 40 geographical miles for that time the inventor is intitled to a reward of L. 7500, and to L 10,000 if the longitude is kept within half a degree. If the method is by improved aſtronomical tables, the author is intitled to L.5000 when they ſhow the diſtance of the moon from the ſun and ſtars, within 15 ſeconds of a degree, anſwering to about 7 minutes of longitude, after allowing half a degree for errors of obſervation, and under certain reſtrictions, and after compariſon with aſtronomical obſervations for a period of 18½ years, during which the lunar irregularities are ſuppoſed to be completed. The ſame rewards are offered to the perſon who ſhall with the like accuracy diſcover any other method of finding the longitude.

Theſe methods require celeſtial obſervations; and any of the phenomena, ſuch as the different apparent places of ſtars with regard to the moon, the beginning and ending of eclipſes, &c. will anſwer the purpoſe: only it is abſolutely neceſſary that ſome variation ſhould be perceptible in the phenomenon in the ſpace of two minutes; for even this ſhort ſpace of time will produce an error of 30 miles in longitude. The moſt proper phenomena therefore for determining the longitude in this manner are the eclipſes of Jupiter's ſatellites. Tables of their motions have been conſtructed, and carefully corrected from time to time, as the mutual attractions of theſe bodies are found greatly to diſturb the regularity of their motions. The difficulty here, however, is to obſerve theſe eclipſes at ſea; and this difficulty has been found ſo great, that no perſon ſeems able to ſurmount it. The difficulty ariſes from the violent agitation of a ſhip in the ocean, for which no adequate remedy has ever yet been found, nor probably will ever be found. Mr Chriſtopher Irwin indeed invented a machine which he called a *marine chair*, with a view to prevent the effects of this agitation; but on trying it in a voyage to Barbadoes, it was found to be totally uſeleſs.

A whimſical method of finding the longitude was propoſed by Meſſrs Whiſton and Ditton from the report and flaſh of great guns. The motion of ſound is known to be nearly equable, from whatever body it proceeds or whatever be the medium. Suppoſing therefore a mortar to be fired at any place the longitude of which is known, the difference between the moment that the flaſh is ſeen and the report heard will give the diſtance between the two places; whence, if we know the latitudes of theſe places, their longitudes muſt alſo be known. If the exact time of the exploſion be known at the place where it happens, the difference of time at the place where it is heard will likewiſe give the difference of longitude. Let us next ſuppoſe the mortar to be loaded with an iron ſhell filled with combuſtible matter, and fired perpendicularly upwards into the air, the ſhell will be carried to the height of a mile, and will be ſeen at the diſtance of near 100; whence, ſuppoſing neither the flaſh of the mortar ſhould be ſeen nor the report heard, ſtill the longitude might be determined by the altitude of the ſhell above the horizon.

According to this plan, mortars were to be fired at certain times and at proper ſtations along all frequented coaſts for the direction of mariners. This indeed might be of uſe, and in ſtormy weather might be a kind of improvement in light-houſes, or a proper addition to them; but with regard to the determination of longitude, is evidently ridiculous.

We ſhall now proceed to give ſome practical directions for finding the longitude at ſea by proper celeſtial obſervations; excluſive of thoſe from Jupiter's Satellites, which, for reaſons juſt mentioned, cannot be practiſed at ſea. In the firſt place, however, it will be neceſſary to point out ſome of thoſe difficulties which ſtand in the way, and which render even this method of finding the longitude precarious and uncertain. Theſe lie principally in the reduction of the obſervations of the heavenly bodies made on the ſurface of the earth to ſimilar obſervations ſuppoſed to be made at the centre; which is the only place where the celeſtial bodies appear in their proper ſituation. It is alſo very difficult to make proper allowances for the refraction of the atmoſphere, by which all objects appear higher than they really are; and another difficulty ariſes from their parallaxes, which makes them, particularly the moon, appear lower than they would otherwiſe do, excepting when they are in the very zenith. It is alſo well known, that the nearer the horizon any celeſtial body is, the greater its parallax will be; and as the parallax and refraction act in oppoſite ways to one another, the former depreſſing and the latter raiſing the object, it is plain, that great difficulties muſt ariſe from this circumſtance. The ſun, for inſtance, whoſe parallax is leſs than the refraction, muſt always appear higher than he really is; but the moon, whoſe parallax is greater than her refraction, muſt always appear lower.

To render obſervations of the celeſtial bodies more eaſy, the commiſſioners of longitude have cauſed an Ephemeris or Nautical Almanack to be publiſhed annually, containing every requiſite for ſolving this important problem which can be put into the form of tables. But whatever may be done in this way, it will be neceſſary to make the neceſſary preparation concerning the dip of the horizon, the refraction, ſemidiameters, parallax, &c. in order to reduce the apparent to the true altitudes and diſtances; for which we ſhall here ſubjoin two general rules.

The principal obſervation for finding the longitude at ſea is that of the moon from the ſun, or from ſome remarkable ſtar near the zodiac. To do this, the operator muſt be furniſhed with a watch which can be depended upon for keeping time within a minute for ſix hours; and with a good Hadley's quadrant, or, which is preferable, a ſextant: and this laſt inſtrument will ſtill be more fit for the purpoſe if it be furniſhed with a ſcrew for moving the index gradually; likewiſe an additional dark glaſs, but not ſo dark as the common kind, for taking off the glare of the moon's light in obſerving her diſtance from a ſtar. A ſmall teleſcope, which may magnify three or four times, is alſo neceſſary to render the contact of a ſtar with the moon's limb more diſcernable. A magnifying glaſs of 1½ or 2 inches focus will likewiſe aſſiſt the operator in reading of his obſervations with the greater facility.

1. *To make the obſervation.* Having examined and adjuſted his inſtrument as well as poſſible, the obſerver is next to proceed in the following manner: If the diſtance of the moon from the ſun is to be obſerved, turn down one of the ſcreens; look at the moon directly through the tranſparent part the horizon-glaſs; and keeping her in view, gently move the index till the ſun's image be brought into the ſilvered part of that glaſs. Bring the neareſt limbs of both objects into contact, and let the quadrant librate a little on the lunar ray; by which means the ſun will appear to riſe and fall by the ſide of the moon; in which motion the neareſt limbs muſt be made to touch one an other exactly by

moving the index. The obſervation is then made; and the diviſion coinciding with that on the Vernier ſcale, will ſhow the diſtance of the neareſt limbs of the objects.

When the diſtance of the moon from a ſtar is to be obſerved when the moon is very bright, turn down the lighteſt ſcreen, or uſe a dark glaſs lighter than the ſcreens, and deſigned for this particular purpoſe; look at the ſtar directly through the tranſparent part of the horizon-glaſs; and keeping it there, move the index till the moon's image is brought into the ſilvered part of the ſame glaſs. Make the quadrant librate gently on the ſtar's ray, and the moon will appear to riſe and fall by the ſtar: move the index between the librations, until the moon's enlightened limb is exactly touched by the ſtar, and then the obſervation is made. In theſe operations, the plane of the quadrant muſt always paſs through the two objects, the diſtance of which is to be obſerved; and for this purpoſe it muſt be placed in various poſitions according to the ſituation of the objects, which will ſoon be rendered eaſy by practice.

The obſervation being made, ſomebody at the very inſtant that the operator calls muſt obſerve by the watch the exact hour, minute, and quarter minute, if there be no ſecond hand, in order to find the apparent time; and at the ſame inſtant, or as quick as poſſible, two aſſiſtants muſt take the altitudes of thoſe objects the diſtance of which is obſerved; after which, the obſervations neceſſary for finding the longitude are completed.

The ephemeris ſhows the moon's diſtance from the ſun, and likewiſe from proper ſtars, to every three hours of apparent time for the meridian of Greenwich; and that the greater number of opportunities of obſerving this luminary may be given, her diſtance is generally ſet down from at leaſt one object on each ſide of her. Her diſtance from the ſun is ſet down while it is between 40 and 120 degrees, ſo that, by means of a ſextant, it may be obſerved for two or three days after her firſt and before her laſt quarter. When the moon is between 40 and 90 degrees from the ſun, her diſtance is ſet down both from the ſun and from a ſtar on the contrary ſide; and, laſtly, when the diſtance is above 120 degrees, the diſtance is ſet down from two ſtars, one on each ſide of her. The diſtance of the moon from objects on the eaſt ſide of her is found in the ephemeris in the 8th and 9th pages of the month; and her diſtance from objects on the weſt is found in the 10 and 11th pages of the month.

When the ephemeris is uſed, the diſtance of the moon muſt only be obſerved from thoſe ſtars the diſtance of which is ſet down there; and theſe afford a ready means of knowing the ſtar from which her diſtance ought to be obſerved. The obſerver has then nothing more to do than to ſet his index to the diſtance roughly computed at the apparent time, eſtimated nearly for the meridian at Greenwich; after which he is to look to the eaſt or weſt of the moon, according as the diſtance of the ſtar is found in the 8th or 9th, or in the 10th or 11, pages of the month; and having found the moon upon the horizon-glaſs, the ſtar will eaſily be found by ſweeping with the quadrant to the right or left, provided the air be clear, and the ſtar be in the line of the moon's ſhorteſt axis produced. The time at Greenwich is eſtimated by turning into time the ſuppoſed longitude from that place, and adding it to the apparent time at the ſhip, or ſubtracting it from it as occaſion requires. The diſtance of the moon from the ſun, or a ſtar, is roughly found at this time, by ſaying, As 180 minutes (the number contained in three hours) is to the difference in minutes between this nearly eſtimated time and the next preceding time ſet down in the ephemeris; ſo is the difference in minutes between the diſtances in the ephemeris for the next preceding and next following times, to a number of minutes; which being added to the next preceding diſtance, or ſubtracted from it, according as it is increaſing or decreaſing, will give the diſtance nearly at the time the obſervation is to be made, and to which the index muſt be ſet.

An eaſier method of finding the angular diſtance is by bringing the objects nearly into contact in the common way, and then fixing the index tight to a certain degree and minute; waiting until the objects are nearly in contact, giving notice to the aſſiſtants to get ready with the altitudes, and when the objects are exactly in contact to call for the altitudes and the exact time by the watch. The obſerver may then prepare for taking another diſtance, by ſetting his index three or four minutes backwards or forwards, as the objects happen to be receding from or approaching to each other; thus proceeding to take the diſtance, altitudes, and time by the watch, as before. Thus the obſerver may take as many diſtances as he thinks proper; but four at the diſtance of three minutes, or three at the diſtance of four minutes, will at all times be ſufficient. Thus not only the eye of the obſerver will be leſs fatigued, but he will likewiſe be enabled to manage his inſtrument with much greater facility in every direction, a vertical one only excepted. If in taking the diſtances the middle one can be taken at any even diviſion on the arch, ſuch as a degree, or a degree and 20 or 40 minutes, that diſtance will be independent of the Nonius diviſion, and conſequently free of thoſe errors which frequently ariſe from the inequality of that diviſion in ſeveral parts of the graduated arch. The obſervation ought always to be made about two hours before or after noon; and the true time may be found by the altitude of the ſun taken at the preciſe time of the diſtance. If three diſtances are taken, then find the time by the altitude correſponding with the middle diſtance; and thus the obſervation will be ſecured from any error ariſing from the irregularity of the going of the watch. As the time, however, found by the altitude of a ſtar cannot be depended upon, becauſe of the uncertainty of the horizon in the night, the beſt way of determining the time for a night obſervation will be by two altitudes of the ſun; one taken on the preceding afternoon, before he is within ſix degrees of the horizon; and the other on the next morning, when he is more than ſix degrees high. It muſt be obſerved, however, that in order to follow theſe directions, it is neceſſary that the atmoſphere ſhould be pretty free from clouds; otherwiſe the obſerver muſt take the obſervation at ſuch times as he can beſt obtain them.

2. *To reduce the obſerved Diſtance of the Sun or a Star from the moon to the true Diſtance.* 1. Turn the longitude into time, add it to the time at the ſhip if the longitude be weſt, but ſubtract it if it be eaſt,

which will give the ſuppoſed time at Greenwich; and this we may call *reduced time*. 2. Find the neareſt noon or midnight both before and after the reduced time in the ſeventh page of the month in the ephemeris. 3. Take out the moon's ſemidiameter and horizontal parallaxes correſponding to theſe noons and midnights, and find their differences. Then ſay, As 12 hours is to the moon's ſemidiameter in 12 hours, ſo is the reduced time to a number of ſeconds; which, either added to or ſubtracted from the moon's ſemidiameter at the noon or midnight juſt mentioned, according as it is increaſing or decreaſing, will give her apparent ſemidiameter; to which add the correction from Table VIII. of the ephemeris, and the ſum will be her true ſemidiameter at the reduced time. And as 12 hours is to the difference of the moon's horizontal parallax in 12 hours, ſo is the reduced time to a fourth number; which, being added to or ſubtracted from the moon's horizontal parallax at the noon or midnight before the reduced time, according as it is increaſing or decreaſing, the ſum or difference will be the moon's horizontal parallax at the reduced time. 4. If the reduced time be nearly any even part of 12 hours, *viz.* $\frac{1}{6}$th, $\frac{1}{4}$th, &c. theſe parts of the difference may be taken, and either added or ſubtracted according to the directions already given, without being at the trouble of working by the rule of proportion. 5. To the obſerved altitude of the ſun's lower limb add the difference betwixt his ſemidiameter and dip; and that ſum will be his apparent altitude. 6. From the ſun's refraction take his parallax in altitude, and the remainder will be the correction of the ſun's altitude. 7. From the ſtar's obſerved altitude take the dip of the horizon, and the remainder will be the apparent altitude. 8. The refraction of a ſtar will be the correction of its altitude. 9. Take the difference between the moon's ſemidiameter and dip, and add it to the obſerved altitude if her lower limb was taken, or ſubtract it if her upper limb was taken; and the ſum or difference will be the apparent altitude of her centre. 10. From the proportional logarithm of the moon's horizontal parallax, taken out of the nautical almanack (increaſing its index by 10), take the logarithmic coſine of the moon's apparent altitude, the remainder will be the proportional logarithm of her parallax in altitude; from which take her refraction, and the remainder will be the correction of the moon's altitude. 11. To the obſerved diſtance of the moon from a ſtar add her ſemidiameter if the neareſt limb be taken, but ſubtract it if the fartheſt limb was taken, and the ſum or difference will be the apparent diſtance. 12 To the obſerved diſtance of the ſun and moon add both their ſemidiameters, and the ſum will be the apparent diſtance of their centres.

3. *To find the true Diſtance of the Objects, having their apparent Altitudes and Diſtances.* 1. To the proportional logarithm of the correction of the ſun or ſtar's altitude, add the logarithmic coſine of the ſun or ſtar's apparent altitude; the logarithmic ſine of the apparent diſtance of the moon from the ſun or ſtar; and the logarithmic co-ſecant of the moon's apparent altitude. The ſum of theſe, rejecting 30 from the index, will be the proportional logarithm of the firſt angle. 2. To the proportional logarithm of the correction of the ſun or ſtar's altitude, add the logarithmic co-tangent of the ſun or ſtar's apparent altitude, and the logarithmic tangent of the apparent diſtance of the moon from the ſun or ſtar. The ſum of theſe, rejecting 20 in the index, will be the proportional logarithm of the ſecond angle. 3. Take the differences between the firſt and ſecond angles, adding it to the apparent diſtance if it be leſs than 90, and the firſt angle be greater than the ſecond; but ſubtracting it if the ſecond be greater than the firſt. If the diſtance be greater than 90, the ſum of the angles muſt be added to the apparent diſtance, which will give the diſtance corrected for the refraction of the ſun or ſtar. 4. To the proportional logarithm of the correction of the moon's altitude add the logarithmic coſine of her apparent altitude; the logarithmic ſine of the diſtance corrected for the ſun or ſtar's refraction, and the logarithmic co-ſecant of the ſun or ſtar's apparent altitude. The ſum, rejecting 30 in the index, will be the proportional logarithm of the third angle. 5. To the proportional logarithm of the correction of the moon's apparent altitude, add the logarithmic co-tangent of her apparent altitude, and the tangent of the diſtance corrected for the ſun or ſtar's refraction; their ſum, rejecting 20 in the index, will be the proportional logarithm of the fourth angle. 6. Take the difference between the third and fourth angles, and ſubtract it from the diſtance corrected for the ſun or ſtar's refraction if leſs than 90, and the third angle be greater than the fourth; or add it to the diſtance if the fourth angle be greater than the third: but if the diſtance be more than 90, the ſum of the angles muſt be ſubtracted from it, to give the diſtance corrected for the ſun or ſtar's refraction, and the principal effects of the moon's parallax. 7. In Table XX, of the ephemeris, look for the diſtance corrected for the ſun and ſtar's refraction, and the moon's parallax in the top column, and the correction of her altitude in the left-hand ſide column; take out the number of ſeconds that ſtand under the former, and oppoſite to the latter. Look again in the ſame table for the corrected diſtance in the top column, and the correction of the moon's altitude in the left-hand ſide column; take out the number of ſeconds that ſtand under the former and oppoſite to the latter. Look again in the ſame table for the corrected diſtance in the top-column, and the correction of the moon's altitude in the the left-hand ſide column; take out the number of ſeconds that ſtand under the former, and oppoſite to the latter. Look again in the ſame table for the corrected diſtance in the top-column, and the principal effects of the moon's parallax in the left-hand ſide column, and take out the number of ſeconds. The difference between theſe two numbers muſt be added to the corrected diſtance if leſs than 90, but ſubtracted from it if greater; and the ſum or difference will be the true diſtance.

4. *To determine the Longitude after having obtained the true Diſtance.* Look in the ephemeris among the diſtances of the objects for the computed diſtance betwixt the moon and the other object obſerved on the given day. If it be found there, the time at Greenwich will be at the top of the column; but if it falls between two diſtances in the ephemeris which ſtand immediately before and after it, and alſo the difference between the diſtance ſtanding before and

the computed diſtance; then take the proportional logarithms of the firſt and ſecond differences, and the difference between theſe two logarithms will be the proportional logarithm of a number of hours, minutes, and ſeconds; which being added to the time ſtanding over the firſt diſtance, will give the true time at Greenwich. Or it may be found by ſaying, As the firſt difference is to three hours, ſo is the ſecond difference to a proportional part of time; which being added as above directed, will give the time at Greenwich. The difference between Greenwich time and that at the ſhip, turned into longitude, will be that at the time the obſervations were made; and will be eaſt if the time at the ſhip is greateſt, but weſt if it is leaſt.

Having given theſe general directions, we ſhall next proceed to ſhow ſome particular examples of finding the longitude at ſea by all the different methods in which it is uſually tried.

1. *To find the Longitude by Computation from the Ship's Courſe.*—Were it poſſible to keep an accurate account of the diſtance the ſhip has run, and to meaſure it exactly by the log † or any other means, then both latitude and longitude would eaſily be found by ſettling the ſhip's account to that time. For the courſe and diſtance being known, the difference of latitude and departure is readily found by the Traverſe Table; and the difference of longitude being known, the true longitude and latitude will alſo be known. A variety of cauſes, however, concur to render this computation inaccurate; particularly the ſhip's continual deflection from the courſe ſet by her playing to the right and left round her centre of gravity; the unequal care of thoſe at the helm, and the diſtance ſuppoſed to be ſailed being erroneous, on account of ſtormy ſeas, unſteady winds, currents, &c. for which it ſeems impoſſible to make any allowance. The place of the ſhip, however, is judged of by finding the latitude every day, if poſſible, by obſervations; and if the latitude found by obſervation agrees with that by the reckoning, it is preſumed that the ſhip's place is properly determined: but if they diſagree, it is concluded that the account of the longitude ſtands in need of correction, as the latitude by obſervation is always to be depended upon.

† See *Log* (perpetual)

Currents very often occaſion errors in the computation of a ſhip's place. The cauſes of theſe in the great depths of the ocean are not well known, though many of the motions near the ſhore can be accounted for. It is ſuppoſed that ſome of thoſe in the great oceans are owing to the tide following the moon, and a certain libration of the waters ariſing from thence; likewiſe that the unſettled nature of theſe currents may be owing to the changes in the moon's declination. In the torrid zone, however, a conſiderable current is occaſioned by the trade-winds, the motion being conſtantly to the weſt, at the rate of eight or ten miles per day. At the extremities of the trade winds or near the 30th degree of north or ſouth latitude, the currents are probably compounded of this motion to the weſtward, and of one towards the equator; whence all ſhips ſailing within theſe limits ought to allow a courſe each day for the current.

When the error is ſuppoſed to have been occaſioned by a current, it ought if poſſible to be tried whether the caſe is ſo or not; or we muſt make a reaſonable eſtimate of its drift and courſe. Then with the ſetting and drift, as a courſe and diſtance, find the difference of latitude and departure; with which the dead reckoning is to be increaſed or diminiſhed: and if the latitude thus corrected agrees with that by obſervation, the departure thus corrected may be ſafely taken as true, and thus the ſhips place with regard to the longitude determined.

Exam. Suppoſe a ſhip in 24 hours finds, by her dead reckoning, that ſhe has made 96 miles of difference of latitude north and 38 miles of departure weſt; but by obſervation finds her difference of latitude 112, and on trial that there is a current which in 24 hours makes a difference of 16 miles latitude north and 10 miles of departure eaſt: Reqnire the ſhip's departure.

	miles		miles.
Diff. lat. by account	96 N.	Departure by account	38 W.
Diff. lat. by current	16 N.	Departure by current	10
True diff. lat.	112		28 W.

Here the dead reckoning corrected by the current gives the difference of latitude 112 miles, which is the ſame as that found by obſervations; whence the departure 28 is taken as the true one.

When the error is ſuppoſed to ariſe from the courſes and diſtances, we muſt obſerve, that if the difference of latitude is much more than the departure, or the direct courſe has been within three points of the meridian, the error is moſt probably in the diſtance. But if the departure be much greater than the difference of latitude, or the direct courſe be within three points of the parallel, or more than five points from the meridian, the error is probably to be aſcribed to the courſe. But if the courſes in general are near the middle of the quadrant, the error may be either in the courſe, or in the diſtance, or both. This method admits of three caſes.

1. When, by the dead reckoning, the difference of latitude is more than once and an half the departure; or when the courſe is leſs than three points: Find the courſe to the difference of latitude and departure. With this courſe and the meridional difference of latitude by obſervation, find the difference of longitude.

2. When the dead reckoning is more than once and an half the difference of latitude; or when the courſe is more than five points: Find the courſe and diſtance with the difference of latitude by obſervation, and departure by account; then with the co-middle latitude by obſervation, and departure by account, find the difference of longitude.

3. When the difference of latitude and departure by account is nearly equal, or the direct courſe is between three and five points of the meridian; Find the courſe with the difference of latitude and departure by account ſince the laſt obſervation. With this courſe and the difference of latitude by obſervation find another departure. Take half the ſum of theſe departures for the true one. With the true departure and difference of latitude by obſervation find the true courſe; then with the true courſe and meridional difference of latitude find the difference of longitude.

2. *To find the Longitude at Sea by a Variation-chart.*—

Dr Halley having collected a great number of obſervations on the variation of the needle in many parts of the world; by that means was enabled to draw certain lines on Mercator's chart, ſhowing the variation in all the places over which they paſſed in the year 1700, at which time he firſt publiſhed the chart; whence the longitude of thoſe places might be found by the chart provided its latitude and variation was given. The rule is, Draw a parallel of latitude on the chart through the latitude found by obſervation; and the point where it cuts the curved line marked with the variation that was obſerved will be the ſhip's place.

Exam. A ſhip finds by obſervation the latitude to be 18° 20′ north; and the variation of the compaſs to be 4° weſt. Required the ſhip's place.—Lay a ruler over 18° 20′ north parallel to the equator; and the point where its edge cuts the curve of 4° weſt variation gives the ſhip's place, which will be found in about 27° 10′ weſt from London.

This method of finding the longitude, however, is attended with two inconveniences. 1. That when the variation lines run eaſt or weſt, or nearly ſo, it cannot be applied; though as this happens only in certain parts of the world, a variation chart may be of great uſe for the reſt. Even in thoſe places indeed where the variation curves do run eaſt or weſt, they may be of conſiderable uſe in correcting the latitude when meridian obſervations cannot be had; which frequently happens on the northern coaſts of America, the Weſtern Ocean, and about Newfoundland; for if the variation can be found exactly, the eaſt and weſt curve anſwering to it will ſhow the latitude. But, 2. The variation itſelf is ſubject to continual change; whence a chart, though ever ſo perfect at firſt, muſt in time become totally uſeleſs; and hence the charts conſtructed by Dr Halley, though of great utility at their firſt publication, became at length almoſt entirely uſeleſs. A new one was publiſhed in 1746 by Meſſrs Mountaine and Dodſon, which was ſo well received, that in 1756 they again drew variation lines for that year, and publiſhed a third chart the year following. They alſo preſented to the Royal Society a curious paper concerning the variation of the magnetic needle, with a ſet of tables annexed, containing the reſult of more than 50,000 obſervations in ſix periodical reviews from the year 1700 to 1756 incluſive, adapted to every five degrees of latitude and longitude in the more frequented oceans; all of which were publiſhed in the Philoſophical tranſactions for 1757.

3. *To find the Longitude by the Sun's Declination.*—Having made ſuch obſervations on the ſun as may enable us to find his declination at the place, take the difference between this computed declination and that ſhown at London by the ephemeris; from which take alſo the daily difference of declination at that time; then ſay, as the daily difference of declination is to the above found difference, ſo is 360 degrees to the difference of longitude. In this method, however, a ſmall error in the declination will make a great one in longitude.

4. *To find the Longitude by the Moon's culminating.*—Seek in the ephemeris for the time of her coming to the meridian on the given day and on the day following, and take their difference; alſo take the difference betwixt the times of culminating on the ſame day as found in the ephemeris, and as obſerved; then ſay, as the daily difference in the ephemeris is to the difference between the ephemeris and obſervation; ſo is 360 degrees to the difference of longitude. In this method alſo a ſmall difference in the culmination will occaſion a great one in the longitude.

5. *By Eclipſes of the Moon.*—This is done much in the ſame manner as by the eclipſes of Jupiter's ſatellites: For if, in two or more diſtant places where an eclipſe of the moon is viſible, we carefully obſerve the times of the beginning and ending, the number of digits eclipſed, or the time when the ſhadow touches ſome remarkable ſpot, or when it leaves any particular ſpot on the moon, the difference of the times when the obſervations were made will give the difference of longitude. Phenomena of this kind, however, occur too ſeldom to be of much uſe.

6. In the 76th volume of the Philoſophical Tranſactions, Mr Edward Pigot gives a very particular account of his method of determining the longitude and latitude of York; in which he alſo recommends the method of determining the longitude of places by obſervations of the *moon's tranſit over the meridian*, The inſtruments uſed in his obſervations were a gridiron pendulum-clock, a two feet and a half reflector, an eighteen inch quadrant made by Mr Bird, and a tranſit inſtrument made by Mr Siſſon.

By theſe inſtruments an obſervation was made, on the 10th of September 1783, of the occultation of a ſtar of the ninth magnitude by the moon, during an eclipſe of that planet, at York and Paris. Beſides this, there were obſervations made by the immerſions of φ *Aquarii* and δ *Piſcium*; the reſult of all which was, that between Greenwich and York the difference of meridians was 4′ 27″.

In 1783, Mr Pigot informs us, that he thought of finding the difference of meridians by obſerving the meridian right aſcenſions of the moon's limb. This he thought had been quite original: but he found it afterwards in the Nautical Almanack for 1769, and in 1784 read a pamphlet on the ſame ſubject by the Abbé Toaldo; but ſtill found that the great exactneſs of this method was not ſuſpected; though he is convinced that it muſt ſoon be univerſally adopted in preference to that from the firſt ſatellite of Jupiter.

After giving a number of obſervations on the ſatellites of Jupiter, he concludes, that the exactneſs expected from obſervations, even on the firſt ſatellite, is much over-rated. "Among the various objections (ſays he), there is one I have often experienced, and which proceeds ſolely from the diſpoſition of the eye, that of ſeeing more diſtinctly at one time than another. It may not be improper alſo to mention, that the obſervation I ſhould have relied on as the beſt, that of Aug. 30. 1785, marked *excellent*, is one of thoſe moſt diſtant from the truth."

After giving a number of obſervations on the eclipſe of the moon Sept. 10. 1783, our author concludes, that the eclipſes of the moon's ſpots are in general too much neglected, and that it might be relied upon much more were the following circumſtances attended to: 1. To be particular in ſpecifying the clearneſs of the ſky. 2. To chooſe ſuch ſpots as are well defined, and leave no heſitation as to the part eclipſed. 3. That every obſerver ſhould uſe, as far as poſſible, teleſcopes equally

equally powerful, or at leaſt the magnifying powers be the ſame. "A principal objection (ſays he) may ſtill be urged, viz. the difficulty of diſtinguiſhing the true ſhadow from the penumbra. Was this obviated, I believe the reſults would be more exact than from Jupiter's firſt ſatellite: Undoubtedly the ſhadow appears better defined if magnified a little; but I am much inclined to think, that, with high magnifying powers, there is greater certainty of chooſing the ſame part of the ſhadow, which perhaps is more than a ſufficient compenſation for the loſs of diſtinctneſs."

The following rule for meridian obſervations of the moon's limb is next laid down: "The increaſe of the moon's right aſcenſion in twelve hours (or any given time found by computation), is to 12 hours as the increaſe of the moon's right aſcenſion between two places found by obſervation is to the difference of meridians.

Example.

Nov. 30. 1782.

h.	′	″		
13	12	57.62	Meridian tranſit of moon's ſecond limb	By clock at Greenwich.
13	13	29.08	Ditto of α♍	
		31.46	Difference of right aſcenſion.	
13	14	8.05	Meridian tranſit of moon's ſecond limb	By clock at York.
13	14	30.13	Ditto of α ♍	
		22.08	Difference at York.	The clocks going nearly ſidereal time, no correction is required.
		31.46	Difference at Greenwich.	
		9.38	Increaſe of the moon's apparent right aſcenſion between Greenwich and York, by obſervation.	

141″ in ſeconds of a degree, ditto, ditto, ditto.

The increaſe of the moon's right aſcenſion for 12 hours, by computation, is 23,340 ſeconds; and 12 hours reduced into ſeconds is 43,200. Therefore, according to the rule ſtated above,

23,340″ : 43,200″ : diff. of merid. =261″.

"Theſe eaſy obſervations and ſhort reduction (ſays Mr Pigott) are the whole of the buſineſs. Inſtead of computing the moon's right aſcenſion for 12 hours, I have conſtantly taken it from the Nautical Almanacks, which give it ſufficiently exact, provided ſome attention be paid to the increaſe or decreaſe of the moon's motion. Were the following circumſtances attended to, the reſults would be undoubtedly much more exact.

"1. Compare the obſervations with the ſame made in ſeveral other places. 2. Let ſeveral and the ſame ſtars be obſerved at theſe places. 3. Such ſtars as are neareſt in right aſcenſion and declination to the moon are infinitely preferable. 4. It cannot be too ſtrongly urged to get, as near as poſſible, an equal number of obſervations of each limb, to take a mean of each ſet, and then a mean of both means. This will in a great meaſure correct the error of teleſcopes and ſight. 5. The adjuſtment of the teloſcopes to the eye of the obſerver before the obſervation is alſo very neceſſary, as the ſight is ſubject to vary. 6. A principal error proceeds from the obſervation of the moon's limb, which may be conſiderably leſſened, if certain little round ſpots near each limb were alſo obſerved in ſettled obſervatories; in which caſe the libration of the moon will perhaps be a conſideration. 7. When the difference of meridians, or of the latitudes of places, is very conſiderable, the change of the moon's diameter becomes an equation.

"Though ſuch are the requiſites to uſe this method with advantage, only one or two of them have been employed in the obſervations that I have reduced. Two-thirds of theſe obſervations had not even the ſame ſtars obſerved at Greenwich and York; and yet none of the reſults, except a doubtful one, differed 15″ from the mean; therefore I think we may expect a ſtill greater exactneſs, perhaps within 10″ if the above particulars be attended to.

"When the ſame ſtars are not obſerved, it is neceſſary for the obſervers at both places to compute their right aſcenſion from tables, in order to get the apparent right aſcenſion of the moon's limb. Though this is not ſo ſatisfactory as by actual obſervation, ſtill the difference will be trifling, provided the ſtar's right aſcenſions are accurately ſettled. I am alſo of opinion, that the ſame method can be put in practice by travellers with little trouble, and a tranſit inſtrument, conſtructed ſo as to fix up with facility in any place. It is not neceſſary, perhaps, that the inſtrument ſhould be perfectly in the meridian for a few ſeconds of time, provided ſtars, nearly in the ſame parallel of declination with the moon, are obſerved; nay, I am inclined to think, that if the inſtrument deviates even a quarter or half a degree, or more, ſufficient exactneſs can be attained; as a table might be computed, ſhowing the moon's parallax and motion for ſuch deviation; which laſt may eaſily be found by the well known method of obſerving ſtars whoſe difference of declination is conſiderable.

"As travellers very ſeldom meet with ſituations to obſerve ſtars near the pole, or find a proper object for determining the error of the line of collimation, I ſhall recommend the following method as original.—Having computed the apparent right aſcenſion of four, ſix, or more ſtars, which have nearly the ſame parallel of declination, obſerve half of them with the inſtrument inverted, and the other half when in its right poſition. If the difference of right aſcenſions between each ſet by obſervation agrees with the computation, there is no error; but if they diſagree, half that diſagreement is the eror of the line of collimation. The ſame obſervations may alſo ſerve to determine, whether the diſtance of the correſponding wires are equal. In caſe of neceſſity, each limb of the ſun might be obſerved in the ſame manner, though probably with leſs preciſion. By a ſingle trial I made above two years ago, the reſult was much more exact than I expected. Mayor's catalogue of ſtars will prove of great uſe to thoſe that adopt the above method.—I am rather ſurpriſed that the immerſions of known ſtars of the ſixth and ſeventh magnitude, behind the dark limb of the moon, are not conſtantly obſerved in fixed obſervatories, as they would frequently be of great uſe."

The annexed rule for finding the ſhip's place, with the miſcellaneous obſervations on different methods, we have been favoured with Mr John M'Lean of the Obſervatory, Edinburgh. The rule was examined and approved of by Sir Joſeph Banks preſident of the Royal Society.

1. With regard to determining the ſhip's place by the help of the courſe and diſtance ſailed, the following rule may be applied.—It will be found as expeditious as any of the common methods by the middle latitude or meridional parts; and is in ſome reſpects preferable, as the common tables of ſines and tangents only are requiſite in applying it.—Let *a* and *b* be the diſtances of two places from the ſame pole in degrees, or their complete latitudes; C the angle which a meridian makes with the rhumb line paſſing through the places; and L the angle formed by their meridians, or the difference of longitude in minutes: then A and B being the logarithmic tangents of $\frac{1}{2}a$ and $\frac{1}{2}b$, S the ſine of C, and S the ſine of (C+1'), we ſhall have the following equation $L=\frac{A\backsim B}{S-S}$ (A). Alſo, from a well known property of the rhumb line, we have the following equation:

$S+E=R+D$, where S is the logarithmic coſine of C, E the logarithm of the length of the rhumb line, or diſtance, D the logarithm of the minute's difference of latitude, and R the logarithm of the radius.

By the help of theſe two equations, we ſhall have an eaſy ſolution of the ſeveral caſes to which the middle latitude, or meridional parts, are commonly applied.

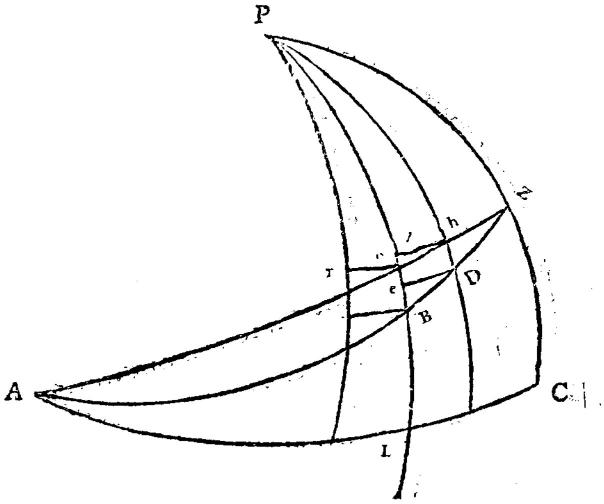
Example. A ſhip from a port, in latitude 56° N. ſails SW. by W. till ſhe arrives at the latitude of 40° N: Required the difference of longitude.

Here $a=34°$, $b=50°$, $C=56° 15''$, $A=9.48534$, $B=9.56107$, $S'=9.9199308$, $S=9.9198464$; therefore, $L=\frac{A\backsim B}{S'-S}=\frac{757300}{844}=897$ the minutes difference of Longitude. Alſo, $S=9.74474$, $D=2.98227$; therefore $E=R+D-S=3.23753$, to which the natural number is 1758, the miles in the rhumb line ſailed over.

2. The common method of finding the difference of longitude made good upon ſeveral courſes and diſtances, by means of the difference of latitude and departure made good upon the ſeveral courſes, is not accurately true.

For example: If a ſhip ſhould ſail due ſouth 600 miles, from a port in 60° north latitude, and then due weſt 600 miles, the difference of longitude found by the common methods of ſolution would be 1053; whereas the true difference of longitude is only 933, leſs than the former by 120 miles, which is more than $\frac{1}{8}$ of the whole. Indeed every conſiderable alteration in the courſe will produce a very ſenſible error in the difference of longitude. Though, when the ſeveral rhumb lines ſailed over are nearly in the ſame direction, the error in longitude will be but ſmall.

The reaſon of this will eaſily appear from the annexed figure, in which the ſhip is ſuppoſed to ſail from Z to A, along the rhumb lines ZB, BA; for if the meridians PZ, PkoeBL be drawn; and very near the latter other two meridians PhD, Pmn; and likewiſe the parallels of latitude Bn, De, mo, hk; then it is plain that De is greater than hk (for De is to hk as the ſine of DP to the ſine of hP): and ſince this is the caſe every where, the departure correſponding to the diſtance BZ and courſe BZC, will be greater than the departure to the diſtance oZ and courſe oZC. And in the ſame manner, we prove that nB is greater than mo; and conſequently, the departure correſponding to the diſtance AB, and courſe ABL, is greater than the departure to the diſtance Ao, and courſe AoL: Wherefore, the ſum of the two departures correſponding to the courſes ABL and BZC, and to the diſtances AB and BZ, is greater than the departure correſponding to the diſtance AZ and courſe AZC; therefore the courſe anſwering to this ſum as a departure, and CZ as a difference of latitude, (AD being the parallel of latitudes paſſing through A), will be greater that the true courſe AZC made good upon the whole. And hence the difference of longitude found by the common rules will be greater than the true difference of longitudes; and the error will be greater or leſs according as BA deviates more or leſs from the direction of BZ.



3. Of determining the ſhip's longitude by lunar obſervations.

Several rules for this purpoſe have been lately publiſhed, the principal object of which ſeems to have been to abbreviate the computations requiſite for determining the true diſtance of the ſun or a ſtar from the moon's centre. This, however, ſhould have certainly been leſs attended to than the inveſtigation of a ſolution, in which conſiderable errors in the datta may produce a ſmall error in the required diſtance. When either of the luminaries has a ſmall elevation, its altitude will be affected by the variableneſs of the atmoſphere; likewiſe the altitude, as given by the quadrant, will be affected by the inaccuracy of the inſtrument, and the uncertainty neceſſarily attending all obſervations made

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(A) A ∽ B ſignifies the difference between A and B.

made at ſea. The ſum of theſe errors, when they all tend the ſame way, may be ſuppoſed to amount to at leaſt one minute in altitude; which, in many caſes, according to the common rules for computing the true diſtance, will produce an error of about 30 minutes in the longitude. Thus, in the example given by Monſ. Callet, in the *Tables Portatives*, if we ſuppoſe an error of one minute in the ſun's altitude, or call it 6° 26′ 34″, inſtead of 6° 27′ 34″; we ſhall find the alteration in diſtance according to his rule to be 54″, producing an error of about 27 minutes in the longitude: for the angle at the ſun will be found, in the ſpherical triangle whoſe ſides are the complement of the ſun's altitude, complement of the moon's altitude, and obſerved diſtance, to be about 26°; and as radius is to the coſine of 26°, ſo is 60″ the ſuppoſed error in altitude, to 54″ the alteration in diſtance. Perhaps the only method of determining the diſtance, ſo as not to be affected by the errors of altitude, is that by firſt finding the angles at the ſun and moon, and by the help of them the corrections of diſtance for parallax and refraction. The rule is as follows:

Add together the complement of the moon's apparent altitude, the complement of the ſun's apparent altitude, and the apparent diſtance of centres; from half the ſum of theſe ſubtract the complement of the ſun's altitude, and add together the logarithmic coſecant of the complement of the moon's altitude, the logarithmic co-ſecant of the apparent diſtances of centres, the logarithmic ſine of the half ſum, and the logarithmic ſine of the remainder; and half the ſum of theſe four logarithms, after rejecting 20 from the index, is the logarithmic coſine of half the angle at the moon.

As radius is to the coſine of the angle at the moon; ſo is the difference between the moon's parallax and refraction in altitude to a correction of diſtance; which is to be added to the apparent diſtance of centres when the angle at the moon is obtuſe; but to be ſubtracted when that angle is acute, in order to have the diſtance once corrected.

In the above formula, if the word *ſun* be changed for *moon*, and *vice verſa*, wherever theſe terms occur, we ſhall find a ſecond correction of diſtance to be applied to the diſtance, once corrected by ſubtraction when the angle at the ſun is obtuſe, but by addition when that angle is acute, and the remainder or ſum is the true diſtance nearly.

In applying this rule, it will be ſufficient to uſe the complement, altitudes, and apparent diſtances of centres, true to the neareſt minute only, as a ſmall error in the angles at the ſun and moon will very little affect the corrections of diſtances.

If D be the computed diſtance in ſeconds, d the difference between the moon's parallax and refraction in altitude, S the ſine of the angle at the moon, and R the radius; then $\frac{d^2S^2}{2DR}$ will be a third correction of Diſtance, to be added to the diſtance twice corrected: But it is plain, from the nature of this correction, that it may be always rejected, except when the diſtance D is very ſmall, and the angle at the moon nearly equal to 90°.

This ſolution is likewiſe of uſe in finding the true diſtance of a ſtar from the moon, by changing the word *ſun* into *ſtar*, and uſing the refraction of the ſtar, inſtead of the difference between the refraction and parallax in altitude of the ſun, in finding the ſecond correction of diſtance.

Ex. Given the obſerved diſtance of a ſtar from the centre of the moon, 50° 8′ 41″; the moon's altitude, 55° 58′ 5″; the ſtar's altitude, 19° 18′ 5″; and the moon's horizontal parallax, 1° 0′ 5″: Required the true diſtance.

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Coſec.——0.02512——*'s co. alt.——70° 42′
                  ☽'s co. alt.——34   4————Coſec.——0.25169
Coſec.——0.11479——obſ. diſt.————50   9————Coſec.——0.11479
                              ————————
                              2)154 55
                              ————————
Sine——9.98950    ——    ——      77  27——————Sine——9.98950
                              ————————
                         Rem. -6  45——————Sine——9.07018
                              ————————            ————————
Sine——9.83688       ——     Rem. 43  23          2)19.42616
      ————————                                    ————————
    2)19.96629                ——————Coſec.——9.71308——58° 54′
      ————————                                             2
Coſec.——9.98314——     15° 54′————                     ————————
                           2                          117  48=☽'s angle.
                      ————————
                      31  48=*'s angle.
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Rad. : Coſec. 117° 48′ : : ☽'s diff. parall. & refract. 1980″ : 923″= 1ſt correct. of diſtance.

Rad. : Coſec. 31° 48′ : ſtar's refract. 162″ : 138″= 2d correct. of diſtance.

Here the firſt correction of diſtance is additive, ſince the angle at the moon is obtuſe; and the ſecond correction is alſo additive, ſince the angle at the ſtar is acute: therefore the ſum 923″+138″=1061″ =17′ 41″, being added to 50° 8′ 41″, the apparent diſtance of the ſtar from the moon's centre, gives 50° 25′ 21″ for the true diſtance of centres nearly;—and 2×L (d+S)—L (2 L R+L 2+L D) =L 8″, which, being added to the diſtance twice corrected, gives 50° 26′ 29″, for the true diſtance. By comparing

ring this diſtance with the computed diſtances in the ephemeris, the time at Greenwich correſponding to that of obſerving the diſtance will be known; and the difference of thoſe times being converted into degrees and minutes, at the rate of 15 degrees to the hour, will give the longitude of the place of obſervation; which will be eaſt if the time at the place be greater than that at Greenwich, but weſt if it be leſs.

LONGITUDINAL, in general, denotes ſomething placed lengthwiſe; thus ſome of the fibres in the veſſels of the human body are placed longitudinally, others tranſverſely or acroſs.

LONGOBARDI. See LANGOBARDI.

LONGOMONTANUS (Chriſtian), a learned aſtronomer, born in a village of Denmark in 1562. He was the ſon of a ploughman; and was obliged to ſuffer during his ſtudies all the hardſhips to which he could be expoſed, dividing his time, like the philoſopher Cleanthes, between the cultivation of the earth and the leſſons he received from the miniſter of the place. At laſt, when he was 15, he ſtole away from his family, and went to Wiburg, where there was a college, in which he ſpent 11 years: and though he was obliged to earn a livelihood, he applied himſelf to ſtudy with ſuch ardour, that among other ſciences he learned the mathematics in great perfection. He afterwards went to Copenhagen; where the profeſſors of that univerſity in a ſhort time conceived ſo high an opinion of him, that they recommended him to the celebrated Tycho Brahe. Longomontanus lived eight years with that famous aſtronomer, and was of great ſervice to him in his obſervations and calculations. At length, being extremely deſirous of obtaining a profeſſor's chair in Denmark, Tycho Brahe conſented, though with ſome difficulty, to deprive himſelf of his ſervice: gave him a diſcharge, filled with the higheſt teſtimonies of his eſteem; and furniſhed him with money for the expence of his long journey. He obtained a profeſſorſhip of mathematics in the univerſity of Copenhagen in 1605; and diſcharged the duty of it worthily till his death, which happened in 1647. He wrote many learned works; amuſed himſelf with endeavouring to ſquare the circle, and pretended that he made that diſcovery; but Dr John Pell, an Engliſh mathematician, attacked him warmly on that ſubject, and proved that he was miſtaken.

LONGTOWN, a town of Cumberland, on the Scots borders, near the conflux of the Eſk and Kirkſop, ſeven miles from Carliſle, and 313 miles from London; it has a market on Thurſday, and a charity-ſchool for 60 children, with two fairs in the year.

LONGUEVILLE, a town of France, in Upper Normandy, and in the territory of Caux, ſeated on the ſmall river Lee, 17 miles north of Rouen. It has the title of a duchy. E. Long. 1. 10. N. Lat. 49. 40.

LONGWY, a town of France, on the frontiers of the duchy of Luxemburgh, with a caſtle, divided into the old and new towns. This laſt was built and fortified by Louis XIV. It is ſeated on an eminence, E. Lon. 5. 51. N. Lat. 40. 32.

LONGUS, a Greek ſophiſt, author of a book intitled Ποιμενικα, or Paſtorals, and a romance containing the loves of Daphnis and Chloe. Huetius, biſhop of Avranches, ſpeaks very advantageouſly of this works but he cenſures the obſcene touches with which it is interſperſed. None of the ancient authors mention him, ſo the time when he lived cannot be certainly fixed. There is an Engliſh tranſlation of this author, which is aſcribed to the late J. Craggs, Eſq; ſecretary of ſtate.

LONICERA, HONEYSUCKLE, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants. The corolla is monopetalous and irregular; the berry polyſpermous, bilocular, and inferior.

Species. 1. The alpigena, or upright red-berried honeyſuckle, riſes with a ſhrubby, ſhort, thick upright ſtem branching ſtrong and erectly four or five feet high; largiſh, ſpear-ſhaped-leaves, in pairs oppoſite; and from the ſides of the branches many red-flowers two's on long foot-ſtalks, each ſucceeded by two red berries joined together at their baſe; it flowers in Auguſt, and the berries ripen in autumn. 2. The cærulea, or blue-berried upright honeyſuckle, riſes with a ſhrubby upright ſtem, branching moderately three or four feet high, with many white flowers proceeding from the ſides of the branches; appearing in May, and ſucceeded by blue berries joined together at their baſe 3. The nigra, or black-berried upright honeyſuckle, riſes with a ſhrubby ſtem, branching three or four feet high, with white flowers ſucceeded by ſingle and diſtinct black-berries. 4. The tartarica, or Tartarian honeyſuckle, riſes with a ſhrubby upright ſtem, branching erectly three or four feet high: heart-ſhaped, oppoſite leaves, and whitiſh erect flowers ſucceeded by red berries, ſometimes diſtinct, and ſometimes double. 5. The diervilla, or yellow-flowered Arcadian honeyſuckle, riſes with ſhrubby upright ſtalks, branching erect to the height of three or four feet; the branches terminated by cluſters of pale yellow flowers, appearing in May and June, and ſometimes continuing till autumn; but rarely ripening ſeeds here. 6. The xyloſteum, or fly honeyſuckle, riſes with a ſtrong ſhrubby ſtem, branching erect to the height of ſeven or eight feet; with erect white flowers proceeding from the ſides of the branches; each ſucceeded by large double red berries, joined together at their baſe. The flowers appear in June, and the berries ripen in September. 7. The ſymphoricarpos, or ſhrubby St Peter's-wort, riſes with a ſhrubby rough ſtem, branching erect four or five feet high, with ſmall greeniſh flowers appearing round the ſtalk in Auguſt. 8. The periclymenum, or common climbing honeyſuckle, hath two principal varieties, viz. The Engliſh wild honeyſuckle, or woodbine of woods and hedges, and the Dutch or German honeyſuckle. The former riſes with ſhrubby, weak, very long ſlender ſtalks, and branches trailing on the ground or climbing round any ſupport; all terminated by oval imbricated heads, furniſhing ſmalliſh flowers of white or red colours, and appearing from June or July till autumn. The Dutch honey ſuckle riſes with a ſhrubby declinated ſtalk, and long trailing purpliſh, branches terminated by oval imbricated heads, furniſhing, large beautiful red flowers of a fragrant odour, appearing in June and July. 9. The caprifolium, or Italian honeyſuckle, riſes with ſhrubby declinated ſtalks, ſending out long ſlender trailing branches, terminated by verticilate or whorled bunches of cloſe-ſitting flowers very fragrant, and white, red, and yellow colours. 10. The ſempervirens, or evergreen trumpet-flowered honeyſuckle, riſes with a ſhrubby declinated ſtalk, ſending out long ſlender trailing branches, terminated by naked verticillate ſpikes, of long, unreflexed, deep ſcarlet flowers, very beautiful, but of little fragrance.

Culture. The moſt eaſy method of propagating theſe plants is by layers or cuttings, eſpecially the latter; both of theſe readily emit roots, and form plants in one year fit for tranſplantation. Some ſorts are alſo propagated by ſuckers and ſeed.

LONSDALE, or *Kirkby* Lonsdale, a town of Weſtmoreland, ſeated on the river Lon, in a pleaſant and rich valley of the ſame name. It is a large well-built town, has a handſome church, and a fine ſtone-bridge over the river. It is well inhabited; and is the beſt town in the county except Kendal. It gives title of Earl to the Lowther family. W. Long. 2. 27. N. Lat. 54. 10.

LOO, a town of the United Provinces, in Guelderland, eight miles weſt of Deventer; where the prince of Orange has a fine palace. E. Long. 6. 0. N. Lat. 52. 18.

LOOF, the after part of a ſhip's bow; or that part of her ſide forward where the planks begin to be incurvated into an arch as they approach the ſtem.

Loof, or *Luff*. See Luff.

LOOK-OUT, in the ſea-language, a watchful attention to ſome important object or event which is expected to ariſe from the preſent ſituation of a ſhip, &c. It is principally uſed in navigation when there is a probability of danger from the real or ſuppoſed proximity of land, rocks, enemies, and, in ſhort, whatever peril ſhe may encounter through inattention, which might otherwiſe have been avoided by a prudent and neceſſary vigilance.

There is always a look-out kept on a ſhip's forecaſtle at ſea, to watch for any dangerous objects lying near her track; and to which ſhe makes a gradual approach as ſhe advances; the mate of the watch accordingly calls often from the quarter-deck, “Look out afore there!” to the perſons appointed for this ſervice.

LOOKING-glasses, are nothing but plain mirrors of glaſs; which, being impervious to the light, reflect the images of things placed before them. See the articles Mirror and Optics.

For the caſting, grinding, and poliſhing of looking glaſſes, ſee the article Glass.

For foliating of looking glaſſes. See the article Foliating.

LOOL, in metallurgy, a veſſel made to receive the waſhings of ores of metals. The heavier or more metalline part of the ores remain in the trough in which they are waſhed; the lighter and more earthy run off with the water, but ſettle in the lool.

LOOM, the weavers frame; a machine whereby ſeveral diſtinct threads are woven into one piece.

Looms are of various ſtructures, accommodated to the various kinds of materials to be woven, and the various manner of weaving them; *viz.* For woollens, ſilks, linens, cottons, cloths of gold, and other works, as tapeſtry, ribbands, ſtockings, &c. divers of which will be found under their proper heads. See Weaving.

The weaver's loom-engine, otherwiſe called the Dutch loom engine, was brought into uſe from Holland to London, in or about the year 1676.

Heir-Loom, in law. See *Heir-Loom*.

Loom, at ſea. If a ſhip appears big, when at a diſtance, they ſay ſhe looms, or appears a great ſail: the term is alſo uſed to denote the indiſtinct appearance of any other diſtant objects.

Loom-gale, at ſea, a gentle eaſy gale of wind, in which a ſhip can carry her top-ſails a-trip.

LOOP, in the iron works, is a part of a ſow or block of caſt iron broken or melted off from the reſt, and prepared for the forge or hammer. The uſual method is, to break off the loop of about three quarters of a hundred weight. This loop they take up with their ſlinging-tongs; and beat it with iron ſledges upon an iron plate near the fire, that ſo it may not fall to pieces, but be in a condition to be carried under the hammer. It is then placed under the hammer, and a little water being drawn to make the hammer move but ſoftly, it is beat very gently, and by this means the droſs and foulneſs are forced off, and after this they draw more and more water by degrees, and beat it more and more till they bring it to a four ſquare maſs, of about two feet long, which they call a bloom.

LOOPING, in metallurgy, a word uſed by the miners of ſome counties of England, to expreſs the running together of the matter of an ore into a maſs, in the roaſting or firſt burning, intended only to calcine it ſo far as to make it fit for powdering. This accident, which gives the miners ſome trouble, is generally owing to the continuing the fire too long in this proceſs.

LOOSE-strife. See Lysimachia.

LOOSA, in botany: a genus of the monogynia order, belonging to the polyandria claſs of plants. The calyx is pentaphyllous, ſuperior; there are five ſubovate, cucullated, and large petals; the nectarium conſiſts of five leaves, gathered into a conical figure, each terminated by two filaments; the capſule is turbinated, unilocular, and trivalved at top; the ſeeds are very numerous; and there are three linear and longitudinal ſinuſes.

LOPES le vega. See Vega.

LOPEZ, or Indian, Root, in the materia medica. The plant to which this article belongs is unknown. Neither the woody nor cortical part of the root has any remarkable ſenſible quality. A ſlight bitterneſs is perceptible; and it is recommended, like ſimarouba, in diarrhœas even of the colliquative kind, in half-dram doſes four times a day. Little of this root has been brought to Europe: but ſome of thoſe who have had an opportunity of employing it, ſpeak in very high terms of the effects obtained from it.

LOPHIUS, Fishing-frog, *Toad-fiſh* or *Sea-devil*; a genus of the branchioſtegeous order of fiſhes, whoſe head is equal in ſize to all the reſt of the body. There are three ſpecies; the moſt remarkable of which is the piſcatorius or common fiſhing-frog, an inhabitant of the Britiſh ſeas. This ſingular fiſh was known to the ancients by the name of Βατραχος, and *rana*; and to us by that of the *fiſhing-frog*, for it is of a figure reſembling that animal in a tadpole ſtate. Pliny takes notice of the artifice uſed by it to take its prey: *Eminentia ſub oculis cornicula turbato limo exerit, aſſultantes piſciculos attrahens, donec tam prope accedunt, ut aſſiliat.* “It puts forth the ſlender horns it has beneath its eyes, enticing by that means the little fiſh to play round, till they come within reach, when it ſprings on them." The fiſhing frog grows to a large ſize, ſome being between four and five feet in length; and Mr Pennant mentions one taken near Scarborough, whoſe mouth was a yard wide. The fiſhermen on that coaſt have a great regard for this fiſh, from a ſuppoſition that it is a great enemy to the dog-fiſh; and whenever they take it with their lines, ſet it at liberty.

It is a fiſh of very great deformity; the head is much bigger than the whole body; it is round at the circumference, and flat above; the mouth of a prodigious wideneſs. The under jaw is much longer than the upper: the jaws are full of ſlender ſharp teeth: in the roof of the mouth are two or three rows of the ſame: at the root of the tongue, oppoſite each other, are two bones of an elliptical form, thick ſet, with very ſtrong ſharp teeth. The noſtrils do not appear externally, but in the upper part of the mouth, are two large orifices that ſerve inſtead of them. On each ſide the upper-jaw are two ſharp ſpines, and others are ſcattered about the upper part of the head. Immediately above the noſe are two long tough filaments, and on the back three others, theſe are what Pliny calls *cornicula*, and ſays it makes uſe of to attract the little fiſh. They ſeem to be like lines flung out for that end. Along the edges of the head and body are a multitude of ſhort fringed ſkins, placed at equal diſtances. The aperture to the gills is placed behind; each of theſe is very wide, ſo that ſome writers have imagined it to be a receptacle for the young in time of danger. The body grows ſlender near the tail, the end of which is quite even. The colour of the upper part of this fiſh is duſky, the lower part white; the ſkin ſmooth.

LORANTHUS, in botany: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The germen is inferior; there is no calyx; the corolla is ſexfid and revoluted; the ſtamina are at the tops of the petals; the berry is monoſpermous. There is only one ſpecies, a native of America, diſcovered by Father Plumier, and found growing naturally at La Vera Cruz by Dr Houſton. It riſes with a ſhrubby ſtalk, eight or ten feet high, dividing into ſeveral branches, having at their ends cluſters of ſmall ſcarlet-coloured flowers, ſucceeded by oval berries with a pulpy covering, and a hard ſhell with one cell, incloſing ſeveral compreſſed ſeeds. It is propagated by ſeeds, which ſhould be ſown ſoon after they are ripe; otherwiſe they are very apt to miſcarry, or lie a year in the ground without germinating. The plants require always to be kept in a bark-ſtove.

LORARII, among the Romans, officers whoſe buſineſs it was, with whips and ſcourges, to compel the gladiators to engage. The *lorarii* alſo puniſhed ſlaves who diſobeyed their maſters.

LORD, in England, a title of honour given to thoſe who are noble either by birth or creation. In this ſenſe, it amounts to much the ſame as *peer of the realm*, or *lord of parliament*. The title is by courteſy alſo given to all the ſons of dukes and marquiſes, and to the eldeſt ſons of earls: and it is alſo a title of honour beſtowed on thoſe who are honourable by their employments; as *lord advocate, lord chambarlaine; lord chancellor, &c.* The word is Saxon, but abbreviated from two ſyllables into one; for it was originally *Illaford*, which by dropping the aſpiration became *Laford*, and afterwards by contraction *Lord*. "The etymology of the word (ſays J. Coates) is well worth obſerving; for it was compoſed of *illaf* "a loaf of bread," and *ford* "to give or afford;" ſo that *Illaford*, now *Lord*, implies a giver of bread;" becauſe, in thoſe ages, ſuch great men kept extraordinary houſes, and fed all the poor; for which reaſon they were called *givers of bread*, a thing now much out of date, great men being fond of retaining the title, but few regarding the practice for which it was firſt given. See Lady.

Houſe of Lords, one of the three eſtates of the parliament of Britain, and compoſed of the Lords Spiritual and Temporal.

1. *The Spiritual Lords* conſiſt of 2 archbiſhops and 24 biſhops; and, at the diſſolution of monaſteries by Henry VIII. conſiſted likewiſe of 26 mitred abbots and two priors; a very conſiderable body, and in thoſe times equal in number to the temporal nobility. All theſe hold, or are ſuppoſed to hold, certain ancient baronies under the king: for William the Conqueror thought proper to change the ſpiritual tenure of frankalmoign or free-alms, under which the biſhops held their lands during the Saxon government into the feodal or Norman tenure by barony; which ſubjected their eſtates to all civil charges and aſſeſſments, from which they were before exempt, and in right of ſucceſſion to thoſe baronies, which were unalienable from their reſpective dignities, the biſhops and abbots were allowed their ſeats in the houſe of lords. But though theſe lords ſpiritual are in the eye of the law a diſtinct eſtate from the lords temporal, and are ſo diſtinguiſhed in moſt of the acts of the Britiſh parliament; yet in practice they are uſually blended together under the name of *the lords*; they intermix in their votes, and the majority of ſuch intermixture joins both eſtates. And from this want of a ſeparate aſſembly, and ſeparate negative of the prelates, ſome writers have argued very cogently, that the lords ſpiritual and temporal are now in reality only one eſtate; which is unqueſtionably true in every effectual ſenſe, though the ancient diſtinction between them ſtill nominally continues. For if a bill ſhould paſs their houſe, there is no doubt of its validity, though every lord ſpiritual ſhould vote againſt it; of which Selden and Sir Edward Coke give many inſtances: as, on the other hand, doubtleſs it would be equally good, if the lords temporal preſent were inferior to the biſhops in number, and every one of thoſe temporal lords gave his vote to reject the bill; though this Sir Edward Coke ſeems to doubt of.

2. The *Temporal Lords* conſiſt of all the peers of the realm, (the biſhops not being in ſtrictneſs held to be ſuch, but merely lords of parliament), by whatever title of nobility diſtinguiſhed; dukes, marquiſes, earls, viſcounts, or barons †. Some of theſe ſit by deſcent, as do all ancient peers; ſome by creation, as do all new-made ones; others, ſince the union with Scotland, by election, which is the caſe of the 16 peers, who repreſent the body of the Scots nobility. Their number is indefinite, and may be increaſed at will by the power of the crown: and once, in the reign of Queen Anne, there was an inſtance of creating no leſs than 12 together; in contemplation of which, in the reign of King George I. a bill paſſed the houſe of lords, and

† See *Nobility*.

was countenanced by the then miniſtry, for limiting the number of the peerage. This was thought by ſome to promiſe a great acquiſition to the conſtitution, by reſtraining the prerogative from gaining the aſcendant in that auguſt aſſembly, by pouring in at pleaſure an unlimited number of new-created lords. But the bill was ill reliſhed, and miſcarried in the houſe of commons, whoſe leading members were then deſirous to keep the avenues to the other houſe as open and eaſy as poſſible.

"The diſtinction of ranks and honours is neceſſary in every well-governed ſtate: in order to reward ſuch as are eminent for their ſervices to the public, in a manner the moſt deſirable to individuals, and yet without burthen to the community; exciting thereby an ambitious yet laudable ardour and generous emulation in others. And emulation, or virtuous ambition, is a ſpring of action which, however dangerous or invidious in a mere republic or under a deſpotic ſway, will certainly be attended with good effects under a free monarchy; where, without deſtroying its exiſtence, its exceſſes may be continually reſtrained by that ſuperior power from which all honour is derived. Such a ſpirit, when nationally diffuſed, gives life and vigour to the community; it ſets all the wheels of government in motion, which, under a wiſe regulator, may be directed to any beneficial purpoſe; and thereby every individual may be made ſubſervient to the public good, while he principally means to promote his own particular views. A body of nobility is alſo more particularly neceſſary in a mixed and compounded conſtitution, in order to ſupport the rights of both the crown and the people, by forming a barrier to withſtand the encroachments of both. It creates and preſerves that gradual ſcale of dignity which proceeds from the peaſant to the prince; riſing like a pyramid from a broad foundation, and diminiſhing to a point as it riſes. It is this aſcending and contracting proportion that adds ſtability to any government; for when the departure is ſudden from one extreme to another, we may pronounce that ſtate to be precarious. The nobility therefore are the pillars, which are reared from among the people, more immediately to ſupport the throne; and, if that falls, they muſt alſo be buried under its ruins. Accordingly, when in the laſt century the commons had determined to extirpate monarchy, they alſo voted the houſe of lords to be uſeleſs and dangerous. And ſince titles of nobility are thus expedient in the ſtate, it is alſo expedient that their owners ſhould form an independent and ſeparate branch of the legiſlature. If they were confounded with the maſs of the people, and like them had only a vote in electing repreſentatives, their privileges would ſoon be borne down and overwhelmed by the popular torrent, which would effectually level all diſtinctions. It is therefore highly neceſſary that the body of nobles ſhould have a diſtinct aſſembly, diſtinct deliberations, and diſtinct powers from the commons." See alſo King, Nobility, Parliament, Commons, *and* Commonalty.

As to the peculiar laws and cuſtoms relating to the houſe of lords: One very ancient privilege is that declared by the charter of the foreſt, confirmed in parliament 9 Hen. III.; viz. that every lord ſpiritual or temporal ſummoned to parliament, and paſſing through the king's foreſts, may, both in going and returning, kill one or two of the king's deer without warrant; in view of the foreſter if he be preſent, or on blowing a horn if he be abſent; that he may not ſeem to take the king's veniſon by ſtealth.

In the next place, they have a right to be attended, and conſtantly are, by the judges of the court of king's-bench and common-pleas, and ſuch of the barons of the exchequer as are of the degree of the coif, or have been made ſerjeants at law; as likewiſe by the king's learned counſel, being ſerjeants, and by the maſters of the court of chancery; for their advice in point of law, and for the greater dignity of their proceedings. The ſecretaries of ſtate, with the attorney and ſolicitor general, were alſo uſed to attend the houſe of peers, and have to this day (together with the judges, &c.) their regular writs of ſummons iſſued out at the beginning of every parliament, *ad tractandum et conſilium impendendum*, though not *ad conſentiendum*: but, whenever of late years they have been members of the houſe of commons, their attendance here hath fallen into diſuſe.

Another privilege is, that every peer, by licence obtained from the king, may make another lord of parliament his proxy, to vote for him in his abſence: A privilege, which a member of the other houſe can by no means have, as he is himſelf but a proxy for a multitude of other people.

Each peer has alſo a right, by leave of the houſe, when a vote paſſes contrary to his ſentiments, to enter his diſſent on the journals of the houſe, with the reaſons for ſuch diſſent; which is uſually ſtyled his proteſt.

All bills likewiſe, that may in their conſequences any way affect the rights of the peerage, are by the cuſtom of parliament, to have their firſt riſe and beginnings in the houſe of peers and to ſuffer no changes or amendments in the houſe of commons.

There is alſo one ſtatute peculiarly relative to the houſe of lords; 6 Ann. c. 23. which regulates the election of the 16 repreſentative peers of North Britain, in conſequence of the 22d and 23d articles of the union; and for that purpoſe preſcribes the oaths, &c. to be taken by the electors; directs the mode of balloting; prohibits the peers electing from being attended in an unuſual manner; and expreſsly provides that no other matter ſhall be treated of in that aſſembly ſave only the election, on pain of incurring a præmunire. Se alſo the Articles Nobility and Peers.

LORDOSIS, (of λαρδος, *bent inwards*), in the medical writings, a name given to a diſtempered ſtate of the ſpine, in which it is bent inward, or towards the anterior parts. It is uſed in oppoſition to *gibbous* or *hump-backed*. See Surgery.

LORETTO, a town of Italy, in the Marca or Marche of Ancona, with a biſhop's ſee. It is ſmall, but fortified; and contains the famous *caſa ſanta*, or holy chapel, ſo much viſited by pilgrims. This chapel, according to the legend, was originally a ſmall houſe in Nazareth, inhabited by the virgin Mary, in which ſhe was ſaluted by the angel, and where ſhe bred our Saviour. After their deaths, it was held in great veneration by all believers in Jeſus, and at length conſecrated into a chapel, and dedicated to the virgin: upon which occaſion St Luke made that identical image, which is ſtill preſerved here, and dignified with the name of our Lady of Loretto. This ſanctified edifice was allowed to ſojourn in Galilee as long as that diſtrict was inhabited by Chriſtians; but when infidels got poſſeſſion of the country, a band of angels, to ſave it from pollution, took it in their arms, and conveyed it from Nazareth to a caſtle in Dalmatia. This fact might have been called in queſtion by incredulous people, had it been performed in a ſecret manner; but that it might be manifeſt to the moſt ſhort-ſighted ſpectator, and evident to all who were not perfectly deaf as well as blind, a blaze of celeſtial light, and a concert of divine muſic, accompanied it during the whole journey; beſides, when the angels, to reſt themſelves, ſet it down in a little wood near the road, all the trees of the foreſt bowed their heads to the ground, and continued in that reſpectful poſture as long as the ſacred chapel remained among them. But, not having been entertained with ſuitable reſpect at the caſtle above-mentioned, the ſame indefatigable angels carried it over the ſea, and placed it in a field belonging to a noble lady called *Lauretta*, from whom the chapel takes its name. This field happened unfortunately to be frequented at that time by highwaymen and murderers: a circumſtance with which the angels undoubtedly were not acquainted when they placed it there. After they were better informed, they removed it to the top of a hill belonging to two brothers, where they imagined it would be perfectly ſecure from the dangers of robbery or aſſaſſination; but the two brothers, the proprietors of the ground, being equally enamoured of their new viſitor, became jealous of each other, quarrelled, fought and fell by mutual wounds. After this fatal cataſtrophe, the angels in waiting finally moved the holy chapel to the eminence where it now ſtands, and has ſtood theſe 400 years, having loſt all reliſh for travelling.

The ſacred chapel ſtands due eaſt and weſt, at the farther end of a large church of the moſt durable ſtone of Iſtria, which has been built around it. This may be conſidered as the external covering or as a kind of great coat to the *caſa ſanta*, which has a ſmaller coat of more precious materials and workmanſhip nearer its body. This internal covering or caſe is of the choiceſt marble, after a plan of San Savino's, and ornamented with baſſo relievos, the workmanſhip of the beſt ſculptors which Italy could furniſh in the reign of Leo X. The ſubject of thoſe baſſo relievos are, the hiſtory of the bleſſed virgin, and other parts of the Bible. The whole caſe is about 50 feet long, 30 in breadth, and the ſame in height; but the real houſe itſelf is no more than 32 feet in length, 14 in breadth, and at the ſides about 18 feet in height; the centre of the roof is four or five feet higher. The walls of this little holy chapel are compoſed of pieces of a reddiſh ſubſtance, of an oblong ſquare ſhape, laid one upon another, in the manner of brick. At firſt ſight, on a ſuperficial view, theſe red-coloured oblong ſubſtances appear to be nothing elſe than common Italian bricks; and which is ſtill more extraordinary, on the ſecond and third view, with all poſſible attention, they ſtill have the ſame appearance. Travellers, however, are aſſured, with great earneſtneſs, that there is not a ſingle particle of brick in their whole compoſition, being entirely of a ſtone, which, though it cannot now be found in Paleſtine, was formerly very common, particularly in the neighbourhood of Nazareth.

The holy houſe is divided within into two unequal portions, by a kind of grate-work of ſilver. The diviſion towards the weſt is about three-fourths of the whole; that to the eaſt is called the *Sanctuary*. In the larger diviſion, which may be conſidered as the main body of the houſe, the walls are left bare, to ſhow the true original fabric of Nazareth ſtone; for they muſt not be ſuppoſed to be bricks. At the lower or weſtern wall there is a window, the ſame through which the angel Gabriel entered at the Annunciation. The architraves of this window are covered with ſilver. There are a great number of golden and ſilver lamps in this chapel: one of the former, a preſent from the republic of Venice, is ſaid to weigh 37 pounds, and ſome of the ſilver lamps weigh from 120 to 130 pounds. At the upper end of the largeſt room is an altar, but ſo low, that from it you may ſee the famous image which ſtands over the chimney in the ſmall room or ſanctuary. Golden and ſilver angels, of conſiderable ſize, kneel around her, ſome offering hearts of gold, enriched with diamonds, and one an infant of pure gold. The wall of the ſanctuary is plated with ſilver; and adorned with crucifixes, precious ſtones, and votive gifts of various kinds. The figure of the Virgin herſelf by no means correſponds with the fine furniture of her houſe: She is a little woman, about four feet in height, with the features and complexion of a negroe. Of all the ſculptors that ever exiſted, aſſuredly St Luke, by whom this figure is ſaid to have been made, is the leaſt of a flatterer; and nothing can be a ſtronger proof of the bleſſed Virgin's contempt for external beauty, than her being ſatisfied witht his repreſentation of her. The figure of the infant Jeſus, by St Luke, is of a piece with that of the Virgin: he holds a large golden globe in one hand, and the other is extended in the act of bleſſing. Both figures have crowns on their heads, enriched with diamonds: theſe were preſents from Ann of Auſtria queen of France. Both arms of the Virgin are incloſed with her robes, and no part but her face is to be ſeen; her dreſs is moſt magnificent, but in a wretched bad taſte; this is not ſurpriſing, for ſhe has no female attendant. She has particular cloaths for the different feaſts held in honour of her, and, which is not quite ſo decent, is always dreſſed and undreſſed by the prieſts belonging to the chapel: her robes are ornamented with all kinds of precious ſtones down to the hem of her garment.

There is a ſmall place behind the ſanctuary, in which are ſhown the chimney, and ſome other furniture which they pretend belonged to the Virgin when ſhe lived at Nazareth; particularly a little earthen porringer, out of which the infant uſed to eat. The pilgrims bring roſaries, little crucifixes, and Agnus Dei's, which the obliging prieſt ſhakes for half a minute in this diſh; after which it is believed they acquire the virtue of curing various diſeaſes, and prove an excellent preventative of all temptations of Satan. The gown which the image had on when the chapel arrived from Nazareth is of red camblet, and carefully kept in a glaſs ſhrine.

Above 100 maſſes are daily ſaid in this chapel, and in the church in which it ſtands. The jewels and riches

riches to be ſeen at any one time in the holy chapel are in ſmall value in compariſon of thoſe of the treaſury, which is a large room adjoining to the veſtry of the great church. In the preſſes of this room are kept thoſe preſents which royal, noble, and rich bigots of all ranks, have, by oppreſſing their ſubjects and injuring their families, ſent to this place. To enumerate every particular would fill volumes. They conſiſt of various utenſils and other things in ſilver and gold; as lamps, candleſticks, goblets, crowns, and crucifixes; lambs, eagles, ſaints, apoſtles, angels, virgins, and infants: then there are cameos, pearls, gems, and precious ſtones, of all kinds and in great numbers. What is valued above all the other jewels is, the miraculous pearl wherein they aſſert that Nature has given a faithful delineation of the virgin ſitting on a cloud with the infant Jeſus in her arms. There was not room in the preſſes of the treaſury to hold all the ſilver pieces which have been preſented to the Virgin. Several other preſſes in the veſtry are completely full. It is ſaid that thoſe pieces are occaſionally melted down by his holineſs for the uſe of the ſtate; and alſo that the moſt precious of the jewels are picked out and ſold for the ſame purpoſe, falſe ſtones being ſubſtituted in their room.

Pilgrimages to Loretto are not ſo frequent with foreigners, or with Italians of fortune and diſtinction, as formerly; nineteen out of twenty of thoſe who make this journey now are poor people, who depend for their maintenance on the charity they receive on the road. To thoſe who are of ſuch a rank in life as precludes them from availing themſelves of the charitable inſtitutions for the maintenance of pilgrims, ſuch journeys are attended with expence and inconveniency, and fathers and huſbands, in moderate or confined circumſtances, are frequently brought to diſagreeable dilemmas, by the raſh vows of going to Loretto, which their wives or daughters are apt to make on any ſuppoſed deliverance from danger. To refuſe, is conſidered by the whole neighbourhood as cruel, and even impious; and to grant, is often highly diſtreſſing, particularly to ſuch huſbands as from affection or any other motive, do not chooſe that their wives ſhould be long out of their ſight. But the poor, who are maintained during their whole journey, and have nothing more than a bare maintenance to expect from their labour at home, to them a journey to Loretto is a party of pleaſure as well as devotion, and by much the moſt agreeable road they can take to heaven. The greateſt concourſe of pilgrims is at the ſeaſons of Eaſter and Whitſuntide. The rich travel in their carriages: A greater number come on horſeback or on mules; or, what is ſtill more common, on aſſes. Great numbers of females come in this manner, with a male friend walking by them as their guide and protector; but the greateſt number of both ſexes are on foot. The pilgrims on foot, as ſoon as they enter the ſuburbs, begin a hymn in honour of the Virgin which they continue till they reach the church. The poorer ſort are received into an hoſpital, where they have bed and board for three days.

The only trade of Loretto conſiſts of roſaries, crucifixes, little Madonas, Agnus Dei's, and medals, which are manufactured here, and ſold to pilgrims. There are great numbers of ſhops full of theſe commodities, ſome of them of a high price; but infinitely the greater part are adapted to the purſes of the buyers, and ſold for a mere trifle. The evident poverty of thoſe manufacturers and traders, and of the inhabitants of this town in general, is a ſufficient proof that the reputation of our Lady of Loretto is greatly on the decline.

In the great church which contains the holy chapel are confeſſionals, where the penitents from every country of Europe may be confeſſed in their own language, prieſts being always in waiting for that purpoſe: each of them has a long white rod in his hand, with which he touches the heads of thoſe to whom he thinks it proper to give abſolution. They place themſelves on their knees in groupes around the confeſſional chair; and when the holy father has touched their heads with the expiatory rod, they retire, freed from the burden of their ſins, and with renewed courage to begin a freſh account.

In the ſpacious area before this church there is an elegant marble fountain, ſupplied with water from an adjoining hill by an aqueduct. Few even of the moſt inconſiderable towns of Italy are without the uſeful ornament of a public fountain. The embelliſhments of ſculpture and architecture are employed with great propriety on ſuch works, which are continually in the people's view; the air is refreſhed and the eye delighted by the ſtreams of water they pour forth; a ſight peculiarly agreeable in a warm climate. In this area there is alſo a ſtatue of Sextus V. in bronze. Over the portal of the church itſelf is a ſtatue of the Virgin; and above the middle gate is a Latin inſcription, importing, that within is the houſe of the mother of God, in which the Word was made fleſh. The gates of the church are likewiſe of bronze, embelliſhed with baſſo relievos of admirable workmanſhip; the ſubjects taken partly from the Old and partly from the New Teſtament, and divided into different compartments. As the gates of this church are ſhut at noon, the pilgrims who arrive after that time can get no nearer the *ſanta caſa* than theſe gates, which are by this means ſometimes expoſed to the firſt violence of that holy ardour which was deſigned for the chapel itſelf. All the ſculpture upon the gates which is within reach of the mouths of thoſe zealots, is in ſome degree effaced by their kiſſes.

There are alſo ſeveral paintings to be ſeen here, ſome of which are highly eſteemed, particularly two in the treaſury. The ſubject of one of theſe is the Virgin's Nativity, by Annibal Carracci; and of the other, a Holy Family, by Raphael. There are ſome others of conſiderable merit which ornament the altars of the great church. Theſe altars, or little chapels, of which this fabric contains a great number, are lined with marble and embelliſhed by ſculpture; but nothing within this church intereſts a traveller of ſenſibility ſo much as the iron grates before thoſe chapels which were made of the fetters and chains of the Chriſtian ſlaves, who were freed from bondage by the glorious victory of Lepanto.

The place where the governor reſides ſtands near the church, and the eccleſiaſtics who were employed in it lodge in the ſame palace, where they receive the pilgrims of high diſtinction. The environs of this town are very agreeable, and in fine weather the high mountains of Croatia may be ſeen from hence. It is ſeated on a mountain, in E. Long. 13. 50. N. Lat. 43. 24.

LORICA, was a cuiraſs, brigantine, or coat of mail, in uſe among the Roman ſoldiers. It was generally made of leather, and is ſuppoſed to be derived from *lorum*—The loricæ were ſet with plates of metal in various forms; ſometimes in hooks or rings like a chain, ſometimes like feathers, and ſometimes like the ſcales of ſerpents or fiſhes, to which plates of gold were often added. There were other lighter cuiraſſes conſiſting only of many folds of linen cloth, or of flax made ſtrong enough to reſiſt weapons. Such ſoldiers as were rated under 1000 drachms, inſtead of the lorica now deſcribed, wore a *pectorale*.—The Roman lorica was made like a ſhirt, and defended the wearer both before and behind, but was ſo contrived that the back part could be occaſionally ſeparated from the front. Some of the loricæ were made of cords of hemp or flax, cloſe ſet together; whence they are called *thoraces*, *bilices*, *trilices*, &c. from the number of the cords fixed one upon another; but theſe were uſed rather in hunting than in the field of battle.

LORICATION, or COATING, in chemiſtry, is the covering a glaſs or earthen veſſel with a coat or cruſt of a matter able to reſiſt the fire, to prevent its breaking in the performing an operation that requires great violence of fire. See CHEMISTRY.

LORIS, in zoology. See LEMUR.

LORIMERS, one of the companies of London, that make bits for bridles, ſpurs, and ſuch like ſmall iron ware. They are mentioned in ſtatute 1 Rich. II. c. 12.—The word ſeems derived from the Latin word *lorum*, "a thong."

LORME (Philibert de), one of the moſt celebrated architects in the 16th century, was born at Lyons. Queen Catherine de Medicis gave him the ſuperintendance of buildings; and he had the direction of thoſe of the Louvre, the Thuilleries, the caſtle of St Anet, St Germains, and other edifices erected by her orders. He wrote ſeveral books of architecture, which are eſteemed; and died about the year 1577.

LORNE, a diviſion of Argyleſhire in Scotland, which gives the title of marquis to the duke of Argyle. It extends above 30 miles in length from north to ſouth, and about nine at its utmoſt breadth; bounded on the eaſt by Braidalbin; on the weſt, by the iſlands; on the north, by Lochaber; and is divided from Knapdale on the ſouth by Loch Etive, on the banks of which ſtands the caſtle of Bergomarn, wherein the courts of juſtice were anciently held. This diſtrict, abounding with lakes, is the moſt pleaſant and fertile part of Argyleſhire, producing plenty of oats and barley. It once belonged to the ancient family of Macdougal, ſtill reſiding on the ſpot; but devolved to the lords of Argyle in conſequence of a marriage with the heireſs, at that time a branch of the Stuart family. The chief place of note in this diſtrict is the caſtle of Dunſtaffnage, a ſeat of the Scottiſh kings previous to the conqueſt of the Picts in 843 by Kenneth II. In this place was long preſerved the famous ſtone, the palladium of North Britain; brought, ſays legend, out of Spain, where it was firſt uſed as a ſeat of juſtice by Gathelus, coeval with Moſes. It continued here as the coronation-chair till the reign of Kenneth II. who removed it to Scone, in order to ſecure his reign; for, according to the inſcription,

Ni fallat fatum. Scoti quocunque locatum
Invenient lapidem, regnare tere intur ibidem.

Some of the ancient regalia were preſerved till the preſent century, when the keeper's ſervants, during his infirm years, embezzled them for the ſilver ornaments; and left only a battle-axe, nine feet long, of beautiful workmanſhip, and ornamented with ſilver.

The caſtle is ſquare; the inſide only 87 feet; partly ruinous, partly habitable. At three of the corners are round towers; one of them projects very little. The entrance is towards the ſea at preſent by a ſtaircaſe, in old times probably by a draw-bridge, which fell from a little gate-way. The maſonry appears very ancient; the tops battlemented. This pile is ſeated on a rock at the mouth of Loch Etive, whoſe waters expand within to a beautiful bay, where ſhips may ſafely ride in all weather. Of this building, the founder of which is unknown, nothing remains except the outer walls, which, though rooſleſs, are ſtill in good order; and within which ſome buildings have been erected, which ſerve as the reſidence of the laird. The duke of Argyle is hereditary keeper under the Crown.—At a ſmall diſtance from the caſtle is a ruined chapel, once an elegant building; and at one end an incloſure, a family-cemetery. Oppoſite to theſe is a high precipice, ending abrupt and turning ſuddenly towards the ſouth-eaſt. A perſon concealed in the receſs of the rock, a little beyond the angle, ſurpriſes friends ſtationed at ſome diſtance beneath the precipice with a very remarkable echo of any word, or even ſentence, he pronounces; which reaches the laſt diſtinct and unbroken. The repetition is ſingle, but remarkably clear.

In 1307, this caſtle was poſſeſſed by Alexander Macdougal lord of Argyle, a friend to the Engliſh; but was that year reduced by Robert Bruce, when Macdougal ſued for peace with that prince, and was received into favour.

We find, about the year 1455, this to have been a reſidence of the lords of the iſles; for here James laſt earl of Douglas, after his defeat in Annandale, fled to Donald, the regulus of the time, and prevailed on him to take arms and carry on a plundering war againſt his monarch James II.

The ſituation of this regal ſeat was calculated for pleaſure as well as ſtrength. The views of mountains, valleys, waters, and iſlands, are delightful. On the north ſide of Loch Etive ſtood the town of Beregonium, ſuppoſed to have been the capital of the Weſt Highlands. It ſeems, from certain mounds, excavations, and other appearances, to have been a ſtrong fortreſs, to prevent invaſion, or to ſecure a retreat, as occaſions might require. On the bank of the ſame loch is the ſite of Ardchattan, a priory of monks of Valliſcaullium in Burgundy, founded in 1330 by Donald Maccoul, anceſtor of the Macdougals of Lorn. Here Robert Bruce, who remained maſter of this country before he got entire poſſeſſion of Scotland, held a parliament or council.—The country abounds in Druidical, Daniſh, and other monuments.

LORRAIN, a ſovereign ſtate of Europe, bounded on the north by Luxemburg and the archbiſhoprick of Treves, on the eaſt by Alſace and the duchy of Deux

Ponts, on the ſouth by Franche comté, and on the weſt by Champagne and the duchy of Bar. It is about 100 miles in length, and 75 in breadth; and abounds in all ſorts of corn, wine, hemp, flax, rape-ſeed, game, and fiſh, with which it carries on ſome trade, and in general all the neceſſaries of life. There are fine meadows and large foreſts, with mines of iron, ſilver, and copper, as alſo ſalt-pits. There are a great number of rivers; of which the principal are the Meaſe or Meuſe, the Moſelle, the Seille, the Meure, and the Sarre. It is divided into three parts; the duchy of Lorrain, properly ſo called, which was heretofore a ſovereign ſtate; the duchy of Barr, which formerly belonged to the dukes of Lorrain, but afterwards came under the government of France; and the third comprehends the three biſhoprics of Metz, Toul, and Verdun, which have belonged to France ever ſince the year 1552. In 1733, the emperor of Germany being at war with France, this laſt got poſſeſſion of the duchy of Lorrain; and when there was a peace made in 1735, it was agreed, that Staniſlaus king of Poland, father-in-law to the king of France, ſhould poſſeſs theſe duchies, and that after his death they ſhould be united for ever to the crown of France. It was alſo then agreed, that Francis Stephen, duke of Lorrain, and the emperor's ſon-in-law, ſhould have the grand duchy of Tuſcany as an equivalent for Lorrain. After the death of the great duke of Tuſcany, in 1737, King Staniſlaus and the duke of Lorrain took poſſeſſion of their reſpective dominions, and the ceſſion was confirmed and guarantied by a treaty in 1738. The inhabitants are laborious and valiant, and their religion is the Roman Catholic. They have but little trade with ſtrangers, becauſe they have no navigable rivers, and becauſe they have all neceſſaries within themſelves; but what little trade they have conſiſts of corn and linen cloth. Nanci is the capital town.

LORRAIN (Robert le), an eminent ſculptor, born at Paris in 1666. From his infancy, he made ſo rapid a progreſs in the art of deſigning, that at the age of 18 the celebrated Girardon intruſted him with the care of teaching his children and correcting his diſciples. He committed to him alſo, in conjunction with Nouliſſon, the execution of the famous tomb of Cardinal Richelieu in the Sorbonne, and his own tomb at St Landres in Paris. On his return from Rome, he finiſhed ſeveral pieces at Marſeilles, which had been left imperfect by the death of Mr Puget. He was received into the academy of Sculpture in 1701. His *chief d'œuvre* is Galatea, a work univerſally admired. Lorrain afterwards made a Bacchus for the gardens at Verſailles, a Faun for thoſe of Marly; and ſeveral bronzes, among which is an Andromeda; all in an excellent taſte. This artiſt ſucceeded chiefly in heads; and more particularly in that of young girls, which he performed with incomparable delicacy and truth.

LORRAIN (Claude.) See CLAUDE.

LOTEN (John), a good landſcape painter of the Engliſh ſchool; though a native of Switzerland. His taſte led him to ſolemn and dreary ſcenes, as landſtorms accompanied with ſhowers of rain, &c. and he ſeldom omitted to introduce oak-trees in his proſpects: his landſcapes are generally large; and he painted with nature, truth, and force. But the effect of his compoſition had been much greater if he had been leſs cold in his colouring: for the judicious eye is not pleaſed with the darkiſh tint that predominates in it. He died in London about 1681.

LOTHIAN, a name given to three counties of Scotland, viz. Haddington-ſhire, Edinburgh-ſhire, and Linlithgow-ſhire; otherwiſe called *Eaſt*, *Mid*, and *Weſt* Lothians.

1. Eaſt Lothian, or Haddington-ſhire, is bounded on the north-weſt by the Frith of Forth; and on the eaſt by the German Sea; on the ſouth-eaſt by Berwickſhire; and on the weſt by the county of Edinburgh. It extends about 25 miles from eaſt to weſt, and where broadeſt, nearly 15 from north to ſouth. The coaſt, advancing northward into the Frith, forms an irregular curve.—This is one of the moſt fruitful counties in Scotland, producing great quantities, of wheat and all ſorts of grain, well-watered, and plentifully ſupplied with fiſh, fowl, fuel, and all the neceſſaries of life. It abounds with towns, villages, and farms, interſperſed with a great number of agreeable houſes belonging to perſons of rank and fortune. For cultivation, populouſneſs, and fertility, this ſhire may vie with any tract of land in the iſland of Great Britain. Over and above the farming, which turns out to great account, the people towards the ſea-coaſt employ themſelves in the fiſhery, ſalt-making, and in foreign trade; and ſome of the more inland inhabitants engage in the linen and woollen manufactures. Limeſtone and coal are found in moſt parts of the country, and great numbers of ſheep are fed on the hills of Lammermuir.

2. Edinburgh-ſhire, or Mid-Lothian, is about 35 miles long, but varies in its breadth in different places from five to 16 miles. It is bounded on the eaſt by Haddington-ſhire; on the weſt by the ſhire of Linlithgow; on the ſouth, by Tweeddale or Peebles-ſhire; and on the north, by part of Weſt-Lothian and the Frith of Forth. The aſpect of the country is in general level and pleaſant, interſperſed with a few hills, that help to exhibit agreeable proſpects. It is well watered with rivers, and ſhaded with woods. It produces plenty of coal, lime-ſtone, a ſoft black marble, and ſome copper ore. The ſoil, of itſelf fertile, is finely cultivated, and yields as plentiful harveſts of excellent wheat as are found in any part of Great Britain. The whole ſhire is interſperſed with noble houſes and plantations, belonging to noblemen and gentlemen of fortune. The farmers are maſters of the ſcience of agriculture; and wealthy in conſequence of their ſkill, ſome of them paying 500 l. of yearly rent. The country is well inhabited, and preſents us with a good number of towns and populous villages. Along the ſea-coaſt the common people ſubſiſt by fiſhing, and traffic in coals and ſalt, and ſome few carry on a ſmuggling commerce. Thoſe in the inland are employed in farming, and ſome branches of the weaving manufacture. The ſheriffalty of this ſhire is in the gift of the crown; and Edinburgh is a county in itſelf.

3. The ſhire of Linlithgow, or Weſt Lothian, is bounded on the north by the Frith of Forth. The ſmall river Almond divides it from Edinburghſhire on the eaſt. On the ſouth-weſt it joins the county of Lanerk; and on the weſt it is parted from Stirlingſhire by Avon, a ſmall river. Its form, though ir-

regular, approaches to a parallelogram. It meaſures from north-eaſt to ſouth-weſt, nearly 20 miles. Its breadth, except on the ſhore of the Frith, does not exceed 12.—The country is pleaſant and fertile, abounding with corn and paſturage. Here is found plenty of coal, limeſtone and lead ore; nay, in the reign of James VI. it produced a rich mine of ſilver.

LOTION, is, ſtrictly ſpeaking, ſuch waſhing as concerns beautifying the ſkin, by cleanſing it of thoſe deformities which a diſtempered blood throws upon it. Medicines of this kind, however, are for the moſt part inſignificant, and ſometimes very dangerous; the only proper method of treating theſe diſorders is, by adminiſtering ſuch medicines as tend to correct the morbid ſtate of the conſtitution from whence they ariſe.

Lotion, in pharmacy, denotes a preparation of medicines, by waſhing them in ſome liquid, either made very light, ſo as to take away only the dregs; or ſharp, ſo as to penetrate them, in order to clear them of ſome ſalt, or corroſive ſpirit as is done to antimony, precipitates, magiſteries, &c. or intended to take away ſome foulneſs or ill quality, or to communicate ſome good one.

LOTAPHAGI (anc. geog.), a people of the Regio Syrtica (ſo called from their living on the lotus); inhabiting between the two Syrtes, from the Cinyphus to Triton. The lotus was ſaid to be a food ſo luſcious, as to make ſtrangers forget their native country. A ſweet wine was expreſſed from it, which did not keep above ten days (Pliny). Lotaphagi of Homer. See Meninx.

LOTTERY, a kind of public game at hazard, frequent in Britain, France and Holland, in order to raiſe money for the ſervice of the ſtate; being appointed in Britain by the authority of parliament, and managed by commiſſioners appointed by the lords of the treaſury for that purpoſe. It conſiſts of ſeveral numbers of blanks and prizes, which are drawn out of wheels, one of which contains the numbers, and the other the correſponding blanks or prizes.

The Romans invented lotteries to enliven their Saturnalia. This feſtival begun by the diſtribution of tickets which gained ſome prize. Auguſtus made lotteries which conſiſted of things of little value; but Nero eſtabliſhed ſome for the people, in which 1000 tickets were diſtributed daily, and ſeveral of thoſe who were favoured by Fortune got rich by them. Heliogabalus invented ſome very ſingular: the prizes were either of great value or of none at all; one gained a prize of ſix ſlaves, and another of ſix flies; ſome got valuable vaſes, aud others vaſes of common earth. A lottery of this kind exhibited an excellent picture of the inequality with which Fortune diſtributes her favours.

The firſt Engliſh lottery we find mentioned in hiſtory was drawn A. D. 1569. It conſiſted of 40,000 lots, at 10 s. each lot: the prizes were plate; and the profits were to go towards repairing the havens of the kingdom. It was drawn at the weſt door of St Paul's cathedral. The drawing began on the 11th of January 1562, and continued inceſſantly drawing, *day and night*, till the 6th of May following; as Maitland from Stowe, informs us in his Hiſtory, Vol. I. p. 257. There were then only *three* lottery-offices in London. The propoſals for this lottery were publiſhed in the years 1567 and 1568. It was at firſt intended to have been drawn at the houſe of Mr Dericke, her majeſty's ſervant (*i. e.* her jeweler), but was afterwards drawn as abovementioned.

Dr Rawlinſon ſhowed the Antiquary Society, 1748, "A Propoſal for a very rich lottery, general without any blanks, contayning a great number of good prizes as well as of redy money as of plate and certain ſorts of merchandizes, having been valued and priſed by the commandment of the queen's moſt excellent majeſties order, to the entent that ſuch commodities as may chance to ariſe thereof after the charges borne may be converted towards the reparations of the havens and ſtrength of the realme, and towards ſuch other public good workes. The number of lotts ſhall be foure hundred thouſand, and no more; and every lott ſhall be the ſum of tenne ſhillings ſterling, and no more. To be filled by the feaſt of St Bartholomew. The ſhew of priſes are to be ſeen in Cheapſide at the ſign of the Queene's Armes, the houſe of Mr Dericke, goldſmith, ſervant to the queene. Some other orders about it in 1567-8. Printed by Hen. Bynneyman."

"In the year 1612, king James, in ſpecial favour for the preſent plantation of Engliſh colonies in Virginia, granted a lottery, to be held at the weſt end of St Paul's; whereof one Thomas Sharplys a taylor of London, had the chief prize, which was 4000 crowns in fair plate." Baker's Chronicle.

In the reign of queen Anne, it was thought neceſſary to ſuppreſs lotteries, as nuiſances to the public. Since that time, however, they have been licenſed by an act of parliament, under various regulations. The act paſſed in 1778 reſtrains any perſon from keeping an office for the ſale of tickets, ſhares, or chances, or for buying, ſelling, inſuring, or regiſtering, without a licence; for which licence each office-keeper muſt pay 50l. to continue in force for one year, and the produce to be applied towards defraying the expences of the lottery. And no perſon is allowed to ſell any ſhare or chance leſs than a ſixteenth, on the penalty of 50 l. All tickets divided into ſhares or chances are to be depoſited in an office, to be eſtabliſhed in London by the commiſſioners of the treaſury, who are to appoint a perſon to conduct the buſineſs thereof; and all ſhares are to be ſtamped by the ſaid officer, who is to give a receipt for every ticket depoſited with him. The number of all tickets ſo depoſited are to be entered in a book, with the names of the owners, and the number of ſhares into which they are divided; and two pence for each ſhare is to be paid to the officer on depoſiting ſuch tickets, who is therewith to pay all expences incident to the office. All tickets depoſited in the office are to remain there three days after the drawing. And any perſon keeping an office, or ſelling ſhares, or who ſhall publiſh any ſcheme for receiving moneys in conſideration of any intereſt to be granted in any ticket in the ſaid lottery, &c. without being in poſſeſſion of ſuch ticket, ſhall forfeit 500l. and ſuffer three months impriſonment. And no buſineſs is to be tranſacted at any of the offices after eight in the evening, except on the evening of the Saturday preceding the drawing. No perſon is to keep any office for the ſale of tickets, &c. in Oxford or Cambridge, on penalty of 20l. Before this regulating ſtatute took place, there were upwards of 400 lottery offices in and about London only; but the whole number afterwards, for all Britain, as appeared by the liſt publiſhed by authority, amounted to no more than 51.

LOTUS, or BIRD'S-FOOT TREFOIL, in botany: A genus of the decandria order, belonging to the diadelphia claſs of plants; and in the natural method ranking under the 32d order, *Papilionaceæ*. The legumen is cylindrical, and very erect; the alæ cloſing upwards longitudinally; the calyx is tubulated. There are many ſpecies, but only five or ſix are uſually cultivated in our gardens. 1. The tetragonolobus, or winged pea, hath trailing, ſlender, branchy ſtalks, about a foot long, garniſhed with trifoliate oval leaves; and, from the axillas of the branches, large, papilionaceous red flowers, one on each footſtalk; ſucceeded by tetragonous ſolitary pods, having a membranous wing or lobe, running longitudinally at each corner. It flowers in June and July, and the ſeeds ripen in autumn. 2. The creticus, or Cretan ſilvery lotus, hath a ſlender under ſhrubby ſtalk, riſing by ſupport three or four feet high, ornamented with trifoliate bright, ſilvery leaves; and branches terminated by ſeveral yellow flowers ſucceeded by ſubternate pods. 3. The Jacobæus, or lotus of St James's iſland, hath upright herbaceous ſtalks branching two or three feet high, and, from the upper part of the branches, long ſlender footſtalks, terminated each by three or five yellowiſh purple flowers, appearing moſt part of the ſummer and autumn, and ſucceeded by ſubternate pods filled with plenty of ſeeds. 4. The hirſutus, or hairy Italian lotus, hath upright hairy ſtalks branching a yard high; and terminated by heads of whitiſh hoary-cupped flowers appearing in June, which are ſucceeded by oval pods full of ſeed, which ripens in autumn. 5. The dorcynium, white Auſtrian lotus, or ſhrub-trefoil of Montpelier, has underſhrubby ſmooth ſtalks, branching three or four feet high, and the branches terminated by aphyllous heads of ſmall white flowers appearing in June, ſucceeded by ſhort pods. 6. The edulis, ſends forth ſeveral trailing ſtalks about a foot long, furniſhed at their joints with trifoliate, roundiſh, ſmooth leaves, having oval ſtipulæ. The flowers come ſingly from the ſides of the ſtalks, on long peduncles, with three oval floral leaves, the length of the flower: the latter is ſmall, yellow; and is ſucceeded by a thick arched pod, having a deep furrow on its outſide.

Culture, &c. The firſt ſpecies is a hardy annual, and is eaſily raiſed from ſeed ſown any time from the mouth of February to May; the plants requiring no other culture than to be kept free from weeds. It was formerly cultivated as an eſculent; for its young green ſeed-pods may be dreſſed and eat like peaſe, or in the manner of kidney-beans. The other ſpecies may be propagated either by ſeeds or cuttings, but require to be kept in pots in the green-houſe during the winter-ſeaſon.——The ſixth ſpecies is an annual, and a native of ſeveral parts of Italy, where the inhabitants eat the young pods as we do kidney beans. The green pods of the firſt ſpecies were formerly gathered in Scotland and dreſſed in the manner of kidney beans, and are uſed ſo ſtill in ſome of the northern counties of England; but they are coarſe, and not very agreeable to ſuch as have been accuſtomed to feed upon better fare.

Lotus of Homer. See DIOSPYROS.

Egyptain Lotus. See NYMPHÆA.

Libyan Lotus. See RHAMNUS.

LOVAGE, in botany. See LIGUSTICUM.

LOVE, in a large ſenſe of the word denotes all thoſe affections of the pleaſing kind which objects and incidents raiſe in us; thus we are ſaid to *love* not only intelligent agents of morally good diſpoſitions, but alſo ſenſual pleaſures, riches, and honours.

LOVE, in its uſual and more apropptiate ſignification, may be defined, "that affection which, being compounded of animal deſire, eſteem, and benevolence, becomes the bond of attachment and union between individuals of the different ſexes; and makes them feel in the ſociety of each other a ſpecies of happineſs which they experience no where elſe." We call it an *affection* rather than a *paſſion*, becauſe it involves a deſire of the happineſs of object: And that its conſtituent parts are thoſe which have been juſt enumerated, we ſhall firſt endeavour to prove, and then proceed to trace its riſe and progreſs from a ſelfiſh appetite to a generous ſentiment.

Animal deſire is the actual energy of the ſenſual appetite: and that it is an eſſential part of the complex affection, which is properly called *love*, is apparent from this conſideration, that though a man may have ſentiments of eſteem and benevolence towards women who are both old and ugly, he never ſuppoſes himſelf to be in love of any woman, to whom he feels not the ſenſual appetite to have a ſtronger tendency than to other individuals of her ſex. On the other hand, that animal deſire *alone* cannot be called the affection of love is evident; becauſe he who gratifies ſuch a deſire without eſteeming its object, and wiſhing to communicate at the ſame time that he receives enjoyment, loves not the woman, but himſelf. Mere animal deſire has nothing in view but the ſpecies and the ſex of its object; and before it make a ſelection, it muſt be combined with ſentiments very different from itſelf. The firſt ſentiment with which it is combined, and by which a man is induced to prefer one woman to another, ſeems to be that by which we are delighted with gracefulneſs of perſon, regularity of features, and beauty of complexion. It is not indeed to be denied that there is ſomething irreſiſtible in female beauty. The moſt ſevere will not pretend, that they do not feel an immediate prepoſſeſſion, in favour of a handſome woman; but this prepoſſeſſion even when combined with animal deſire, does not conſtitute the whole of that affection which is called *love*. Savages feel the influence of the ſenſual appetite, and it is extremely probable that they have ſome ideas of beauty; but among ſavages the affection of love is ſeldom felt. Even among the lower orders in civil ſociety it ſeems to be a very groſs paſſion, and to have in it more of the ſelfiſhneſs of appetite than of the generoſity of eſteem. To theſe obſervations many exceptions will no doubt be found (A); but we ſpeak of ſavages in general, and of the great body of the labouring poor, who in the choice of their mates do not ſtudy—who indeed are incapable of ſtudying,

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(A) Such as the negroes whoſe ſtory is ſo pathetically told by Addiſon in N° 215 of the Spectator; the two lovers who were killed by lightning at Staunton Harcourt, Auguſt 9th, 1718, (ſee *Pope's Letters*); and many others which will occur to every reader.

dying, that rectitude of mind and thoſe delicacies of ſentiment without which neither man nor woman can deſerve to be eſteemed.

In the ſavage ſtate, and even in the firſt ſtages of refinement, the bond of union between the ſexes ſeems to conſiſt of nothing more than mere animal deſire and inſtinctive tenderneſs for their infant progeny. The former impels them to unite for the propagation of the ſpecies; and the latter preſerves the union till the children, who are the fruit of it, be able to provide for their own ſubſiſtence. That in ſuch unions, whether caſual or permanent, there is no mutual eſteem and benevolence, is apparent from the ſtate of ſubjection in which women are held in rude and uncultivated nations, as well as from the manner in which marriages are in ſuch nations contracted.

Sweetneſs of temper, a capital article in the female character, diſplays itſelf externally in mild looks and gentle manners, and is the firſt and perhaps the moſt powerful inducement to love in a cultivated mind. "But ſuch graces (ſays an ingenious writer*) are ſcarce diſcernible in a female ſavage; and even in the moſt poliſhed woman would not be perceived by a male ſavage. Among ſavages, ſtrength and boldneſs are the only valuable qualities. In theſe, females are miſerably deficient; for which reaſon they are contemned by the males as beings of an inferior order. The North American tribes glory in idleneſs: the drudgery of labour degrades a *man* in their opinion, and is proper for *women* only. To join young perſons in marriage is accordingly the buſineſs of the parents; and it would be unpardonable *meanneſs* in the bridegroom to ſhow any *fondneſs* for the bride. In Guiana a woman never eats with her *huſband*, but after every meal attends him with water for waſhing; and in the Caribbee iſlands ſhe is not permitted to eat even in the preſence of her huſband. Dampier obſerves in general, that among all the wild nations with which he was acquainted, the women carry the burdens, while the men walk before and carry nothing but their arms; and that women even of the higheſt rank are not better treated. In Siberia, and even in Ruſſia, the capital excepted, men till very lately treated their wives in every reſpect like ſlaves. It might indeed be thought, that animal deſire, were there nothing elſe, ſhould have raiſed women to ſome degree of eſtimation among men; but male ſavages, utter ſtrangers to decency and refinement, gratify animal deſire with as little ceremony as they do hunger or thirſt.

*Sketches of the Hiſtory of Man.

"Hence it was that in the early ages of ſociety a man *purchaſed* a woman to be his wife as one purchaſes an ox or a ſheep to be food; and valued her only as ſhe contributed to his ſenſual gratification. Inſtances innumerable might be collected from every nation of which we are acquainted with the early hiſtory; but we ſhall content ourſelves with mentioning a few. Abraham bought Rebekah and gave her to his ſon Iſaac for a wife ‡. Jacob having nothing elſe to give, ſerved Laban 14 years for two wives †. To David, demanding Saul's daughter in marriage, it was ſaid, "The king deſireth not any dowry, but an hundred foreſkins of the Philiſtines ‡." In the Iliad Agamemnon offers his daughter to Achilles for a wife; and ſays that he would not demand for her any *price* §. By the laws of Ethelbert king of England, a man who committed adultery with his neighbour's wife was obliged to pay the huſband a fine, and to *buy him another wife*. ||" But it is needleſs to multiply inſtances; the practice has prevailed univerſally among nations emerging from the ſavage ſtate, or in the rudeſt ſtage of ſociety: and wherever it prevailed, men could not poſſibly have for the fair ſex any of that tender regard and eſteem which conſtitute ſo eſſential a part of the complex affection of love.

‡ Gen. xxi.

† Gen. xxix.

‡ 1 Sam. xviii. 28.

§ Lib. ix.

|| Sect 3.

Accordingly we find the magnanimous Achilles an abſolute ſtranger to that generous affection, though his heart was ſuſceptible of the warmeſt and pureſt friendſhip. His attachment to Patroclus was ſo heroically diſintereſted, that he willingly ſacrificed his own life to revenge the death of his friend; but when Agamemnon threatened to rob him of his favourite female captive, though he felt the inſult offered to his *pride*, he never ſpoke of the *woman* but as a *ſlave* whom he was concerned to preſerve in point of *honour*, and as a teſtimony of his *glory*. Hence it is that we never hear him mention her but as his *ſpoil*, the *reward of war*, or the *gift* which the Grecians gave him.

"And dar'ſt thou threat to ſnatch my *prize* away,
"Due to the deeds of many a dreadful day?
"A *prize* as *ſmall*, O tyrant! match'd with thine,
"As thy own actions if compar'd with mine.
"Thine in each conqueſt is the *wealthy prey*,
"Tho' mine the ſweat and danger of the day.
"Some *trivial preſent* to my ſhips I bear,
"Or barren praiſes pay the wounds of war."

And again, after upbraiding the general with his tyranny and want of regard to merit, he adds, with the greateſt indifference as to the charms of the *woman*,

"Seize on Briſeis, whom the Grecians doom'd
"My *prize of war*, yet tamely ſee *reſum'd*;
"And ſeize ſecure; no more Achilles draws
"His conquering ſword in any woman's cauſe.
"The gods command me to forgive the paſt;
"But let this firſt *invaſion* be the laſt:
"For know, thy blood, when *next* thou dar'ſt *invade*,
"Shall ſtream in vengeance on my reeking blade."

Pope made the language of this rough warrior leſs inconſiſtent with the peculiar reſentment natural to an injured lover than it is in the original (B); but from the

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(B) The original paſſages are:

Και δη μοι γερας αυτος αφαιρησεσθαι απειλεις,
Ωι επι πολλ' εμογησα, δοσαν δε μοι υιες Αχαιων.
Ου μεν σοι ποτε ισον εχω γερας, οπποτ' Αχαιοι
Τρωων ελπερσωσ' ευναιομενον πτολιεθρον.
Αλλα το μεν πλειον πολυαικος πολεμοιο.
Χειρες εμαι διεπουσ' αταρ ην ποτε δασμος ικηται,
Σοι το γερας πολυ μειζον, εγω δ' ολιγον τε φιλον τε
Ερχομ' εχων επι νηας επην κεκαμω πολεμιζων.
Iliad, *Lib.* I.

And, Αλλο δε τοι ερέω, συ δ' ενι φρεσι Βαλλεο σησι
Χερσι μεν ουτι εγωγε μαχησομαι, εινεκα κουρης,
Ουτε σοι, ουτε τω αλλω, επει μ' αφελεσθε γε δοντες.
Των δ' αλλων, α μοι εστι θοη παρα νηι μελαινη,
Των ουκ αν τι φεροις ανελων, αεκοντος εμειο.
Ει δ' αγε μην, πειρησαι, ινα γνωωσι και οιδε
Αιψα τοι αιμα κελαινον ερωησει περι δουρι.

In this latter paſſage the hero ſays expreſsly, "I will not fight with you or with any other man for the ſake of a *girl*; but you ſhall not rob me of any other part of my *property*:" which is ſurely the language of a man to whoſe heart love muſt have been an utter ſtranger.

the laſt quoted paſſage, even as tranſlated by him, it is apparent that Achilles would have been equally hurt had Agamemnon threatened to deprive him of any other part of his plunder. Accordingly he yields up Briſeis, not in grief for a miſtreſs whom he loſes, but in ſullenneſs for an injury that is done him. Nor let it be imagined, that this coldneſs proceeded from the pride of the hero, which would not permit him to acknowledge his love of a captive. With the generous affection of love captives and princeſſes were equally incapable of inſpiring him. He repeatedly affirmed indeed that he delighted in his fair Lyrneſſian ſlave, but it was only as an inſtrument of ſenſual gratification; for as to every thing elſe in a woman, he was ſo totally indifferent, that he declared he would not, when he ſhould be diſpoſed to marry, give himſelf the trouble to make a *choice*, but leave the whole matter to his father.

> " If heav'n reſtore me to my realms with life,
> " The rev'rend Peleus ſhall elect my wife."

Even Agamemnon, of whom Pope and Madam Dacier think more favourably as a lover, ſpeaks the very ſame language when mentioning his favourite captive Chryſeis. In his furious debate with Achilles he calls her indeed

> " A maid unmatch'd in manners as in face,
> " Skill'd in each art, and crown'd with ev'ry grace."

And adds,

> " Not half ſo dear were Clytemneſtra's charms,
> " When firſt her blooming beauties bleſt my arms."

But this was ſaid merely to enhance the value of the *prize*, which for the public good he was about to reſign; for that ſhe was dear to him only as miniſtring to his pleaſure, is paſt diſpute from the language which he had previouſly held with her father, as well as from his requiring grateful Greece to pay a juſt *equivalent*, and to repair his *private loſs*. A man who really *loved* would have thought nothing an *equivalent* for the object of his love; much leſs would he have inſinuated to her father a poſſibility of his diſmiſſing from his embrace a woman whom he eſteemed, when time ſhould have robbed her of every youthful grace.

Since, then, it is ſo apparent, that in the heroic age of Greece even princes and kings were ſtrangers to the generous affection of love, it needs not occaſion much ſurpriſe that the ſame affection has very little influence upon mankind in the loweſt ranks of the moſt poliſhed ſocieties of modern Europe. That this is actually the caſe, that among the generality of uneducated men and women there is no other bond of attachment than the ſenſual appetite, every year furniſhes multiplied proofs. We daily ſee youths, rejected by their miſtreſſes, paying their addreſſes without delay to girls who, in looks, temper, and diſpoſition, are diametrically oppoſite to thoſe whom ſo lately they pretended to love: We daily ſee maidens, ſlighted by their lovers, receiving the addreſſes of men, who, in nothing but their ſex, reſemble thoſe to whom a week before they wiſhed to be married: and we believe it is not very uncommon to find a girl entertaining ſeveral lovers together, that if one or more of them ſhould prove falſe, ſhe may ſtill have a chance not to be totally deſerted. Did eſteem and benevolence, placed on manners and character, conſtitute any part of vulgar love, theſe people would act very differently; for they would find it impoſſible to change their lovers and their miſtreſſes with the ſame eaſe that they change their cloaths.

To this account of love, as it appears in ſavage nations, ſome one may perhaps oppoſe the paintings of the ſofter paſſions in the poems of Oſſian. That bard deſcribes the female character as commanding reſpect and eſteem, and the Caledonian heroes as cheriſhing for their miſtreſſes a flame ſo pure and elevated as never was ſurpaſſed, and has ſeldom been equalled, in thoſe ages which we commonly call moſt enlightened. This is indeed true: and it is one of the many reaſons which have induced Johnſon and others to pronounce the whole a modern fiction. Into that debate we do not enter. We may admit the authenticity of the poems, without acknowledging that they furniſh any exception to our general theory. They furniſh indeed in the manners in which they deſcribe a wonderful anomaly in the general hiſtory of man. All other nations of which we read were in the hunter-ſtate ſavage and cruel. The Caledonians, as exhibited by Oſſian, are gentle and magnanimous. The heroes of Homer fought for plunder, and felt no clemency for a vanquiſhed foe. The heroes of Oſſian fought for fame; and when their enemies were ſubdued, they took them to their boſoms. The firſt of Greeks committed a mean inſult on the dead body of the firſt of Trojans. Among the Caledonians inſults offered to the dead, as well as cruelty to the living, were condemned as infamous. The heroes of Oſſian appear in no inſtance as ſavages. How they came to be poliſhed and refined before they were acquainted with agriculture and the moſt uſeful arts of life, it is not our buſineſs to enquire; but ſince they unqueſtionably were ſo, their treatment of the female ſex, inſtead of oppoſing, confirms our theory; for we never conceived rich cloaths, ſuperb houſes, highly-dreſſed food, or even the knowledge of foreign tongues, to be neceſſary to the acquiſition of a generous ſentiment. Luxury indeed appears to be as inimical to love as barbariſm: and we believe, that in modern nations the tender and exalted affection which deſerves that name is as little known amongſt the higheſt orders of life as among the loweſt. Perhaps the Caledonian ladies of Oſſian reſembled in their manners the German ladies of Tacitus, who accompanied their huſbands to the chace, who fought by their ſides in battle, and partook with them of every danger. If ſo, they could not fail to be reſpected by a race of heroes among whom courage took place of all other virtues: and this ſingle circumſtance, from whatever cauſe it might proceed, will ſufficiently account for the eſtimation of the female character among the ancient Germans and Caledonians, ſo different from that in which it has been held in almoſt every other barbarous nation.

But if among ſavages and the vulgar, love be unknown, it cannot poſſibly be an inſtinctive affection: and therefore it may be aſked, How it gets poſſeſſion of the human heart; and by what means we can judge whether in any particular inſtance it be real or imaginary? Theſe queſtions are of importance, and deſerve to be fully anſwered; though many circumſtances conſpire to render it no eaſy taſk to give to them ſuch anſwers as ſhall be perfectly ſatisfactory. Love can ſubſiſt only between *individuals* of the different ſexes. A man can hardly *love two women* at the ſame time;

and we believe that a woman is ſtill *leſs* capable of *loving at once more than one man.* Love, therefore, has a natural tendency to make men and women pair, or, in other words, it is the ſource of marriage: but in poliſhed Society, where alone this affection has any place, ſo many things beſides mutual attachment are neceſſary to make the married life comfortable, that we rarely ſee young perſons uniting from the impulſe of love, and have therefore but few opportunities of tracing the riſe, progreſs, and conſequences of the affection. We ſhall, however, throw together ſuch reflections as have occurred to us on the ſubject, not without indulging a hope, that they may be uſeful to the younger part of our readers when forming the moſt important connection in life.

We have ſaid, that the perception of beauty, combined with animal deſire, is the firſt inducement which a man can have to prefer one woman to another. It may be added, that elegance of figure, a placid maſculine countenance, with a perſon which indicates ſtrength and agility are the qualities which firſt tend to attach any woman to a particular man. Beauty has been defined ‡, "That particular form, which is the moſt common of all particular forms to be met with in the ſame ſpecies of beings." Let us apply this definition to our own ſpecies, and try, by means of it, to aſcertain what conſtitutes the beauty of the human face. It is evident, that of countenances we find a number almoſt infinite of different forms, of which forms one only conſtitutes the beauty, whilſt the reſt, however numerous, conſtitute what is *not beauty*, but *deformity*, or *uglineſs*. To an attentive obſerver, however, it is evident, that of the numerous particular forms of *uglineſs*, there is not one which includes ſo many faces as are formed after that particular caſt which conſtitutes *beauty*. Every particular ſpecies of the animal as well as of the vegetable creation, may be ſaid to have a fixed or determinate form, to which, as to a centre, nature is continually inclining. Or it may be compared to pendulums vibrating in different directions over one central point; and as they *all* croſs the *centre*, though only *one* paſſes through any *other point*; ſo it will be found that *perfect beauty* is oftener produced by nature than deformity: we do not mean than deformity in *general*, but than any *one kind* and *degree* of deformity. To inſtance in a particular part of a human feature: the line which forms the ridge of the noſe is deemed beautiful when it is *ſtraight*; but this is likewiſe the *central* form, which is oftener found than any one *particular degree* of *concave*, *convex*, or any *other* irregular form that ſhall be propoſed. As we are then more accuſtomed to beauty than deformity, we may conclude *that* to be the reaſon why we approve and admire it, juſt as we approve and admire faſhions of dreſs for no other reaſon than that we are uſed to them. The ſame thing may be ſaid of colour as of form: it is cuſtom alone which determines our preference of the colour of the *Europeans* to that of the *Ethiopians*, and which makes them prefer their own colour to ours; ſo that though habit and cuſtom cannot be the *cauſe* of beauty (ſee BEAUTY), they are certainly the cauſe of our liking it.

That we *do like it* cannot be denied. Every one is conſcious of a pleaſing emotion when contemplating beauty either in man or woman; and when that pleaſure is combined with the gratification of the ſenſual appetite, it is obvious that the ſum of enjoyment muſt be greatly increaſed. The perception of beauty, therefore, neceſſarily directs the energy of the ſenſual appetite to a *particular* object; but ſtill this combination is a mere ſelfiſh feeling, which regards its object only as the *beſt* of many *ſimilar* inſtruments of pleaſure. Before it can deſerve the name of *love*, it muſt be combined with eſteem, which is never beſtowed but upon moral character and internal worth; for let a woman be ever ſo beautiful, and of courſe ever ſo deſirable as an inſtrument of ſenſual gratification, if ſhe be not poſſeſſed of the virtues and diſpoſitions which are peculiar to her ſex, ſhe will inſpire no man with a generous affection. With regard to the outlines, indeed, whether of internal diſpoſition or of external form, men and women are the ſame; but nature, intending them for mates, has given them diſpoſitions, which, though concordant, are, however, different, ſo as to produce together delicious harmony. "The man more robuſt, is fitted for ſevere labour, and for field exerciſes; the woman, more delicate, is fitted for ſedentary occupations, and particularly for nurſing children. The man bold and vigorous, is qualified for being a protector ‡; the woman, delicate and timid, requires protection. Hence it is, that a man never admires a woman for poſſeſſing bodily ſtrength or perſonal courage; and women always deſpiſe men who are totally deſtitute of theſe qualities. The man, as a protector, is directed by nature to govern; the woman, conſcious of inferiority, is diſpoſed to obey. Their intellectual powers correſpond to the deſtination of nature. Men have penetration and ſolid judgment to fit them for governing; women have ſufficient underſtanding to make a decent figure under good government: a greater proportion would excite dangerous rivalſhip between the ſexes, which nature has avoided by giving them different talents. Women have more imagination and ſenſibility than men, which make all their enjoyment more exquiſite; at the ſame time that they are better qualified to communicate enjoyment. Add another capital difference of diſpoſition: the gentle and inſinuating manners of the female ſex tend to ſoften the roughneſs of the other ſex; and wherever women are indulged with any freedom, they poliſh ſooner than men.

"Theſe are not the only particulars that diſtinguiſh the ſexes. With reſpect to the ultimate end of love, it is the privilege of the male, as ſuperior and protector, to make a choice: the female, preferred, has no privilege but barely to conſent or to refuſe. Whether this diſtinction be the immediate reſult of the originally different diſpoſitions of the ſexes, or only the effect of aſſociations inevitably formed, may be queſtioned; but among all nations it is the practice for men to court, and for women to be courted: and were the moſt beautiful woman on earth to invert this practice, ſhe would forfeit the eſteem, however by her external grace ſhe might excite the deſire, of the man whom ſhe addreſſed. The great moral virtues which may be comprehended under the general term *integrity*, are all abſolutely neceſſary to make either men or women eſtimable; but to procure eſteem to the female character, the modeſty peculiar to their ſex is a very eſſential circumſtance. Nature hath provided them with it as a defence againſt the artful ſolicitations of the other

‡ By Pere Buffier in his *Firſt Truths*, and Sir Joſhua Reynolds in the *Idler*.

‡ *Sketches of Man*.

ſex before marriage, and alſo as a ſupport of conjugal fidelity."

A woman, therefore, whoſe diſpoſitions are gentle, delicate, and rather timid than bold, who is poſſeſſed of a large ſhare of ſenſibility and modeſty, and whoſe manners are ſoft and inſinuating, muſt, upon moral principles (See Moral Philosophy), command the eſteem and benevolence of every individual of the other ſex who is poſſeſſed of ſound underſtanding; but if her perſon be deformed, or not ſuch as to excite ſome degree of animal deſire, ſhe will attract no man's love. In like manner, a man whoſe moral character is good, whoſe underſtanding is acute, and whoſe converſation is inſtructive, muſt command the eſteem of every ſenſible and virtuous woman; but if his figure be diſagreeable, his manners unpoliſhed, his habits ſlovenly, and above all, if he be deficient in perſonal courage, he will hardly excite deſire in the female breaſt. It is only when the qualities which command eſteem are, in the ſame perſon, united with thoſe which excite deſire, that the individual ſo accompliſhed can be an object of love to one of the other ſex; but when theſe qualities are thus united, each of them increaſes the other in the imagination of the lover. The beauty of his miſtreſs gives her, in his apprehenſion, a greater ſhare of gentleneſs, modeſty, and every thing which adorns the female character, than perhaps ſhe really poſſeſſes; whilſt his perſuaſion of her internal worth makes him, on the other hand, apprehend her beauty to be abſolutely unrivalled.

To this theory an objection readily offers itſelf, which it is incumbent upon us to obviate. Men and women ſometimes fall in love at firſt ſight, and very often before they have opportunities of forming a juſt eſtimate of each other's moral character: How is this circumſtance to be reconciled with the progreſſive generation of love? We anſwer, By an aſſociation of ideas which is formed upon principles of phyſiognomy. Every paſſion and habitual diſpoſition of mind gives a particular caſt to the countenance, and is apt to diſcover itſelf in ſome feature of the face. This we learn by experience; and in time, without any effort of our own, the idea of each particular caſt of countenance comes to be ſo cloſely aſſociated in our minds with the internal diſpoſition which it indicates, that the one can never afterwards be preſented to our view without inſtantly ſuggeſting the other to the imagination. (See Metaphysics and Physiognomy). Hence it is that every man, who has been accuſtomed to make obſervations, naturally forms to himſelf, from the features and linaments of a ſtranger's face, ſome opinion of his character and fortune. We are no ſooner preſented to a perſon for the firſt time, than we are immediately impreſſed with the idea of a proud, a reſerved, an affable, or a good-natured man; and upon our going into a company of abſolute ſtrangers, our benevolence or averſion, our awe or contempt, riſes inſtantly towards particular perſons, before we have heard them ſpeak a word, or know ſo much as their names or deſignations. The ſame thing happens when we are preſented to the fair ſex. If a woman, ſeen for the firſt time, have that particular caſt of countenance, and that expreſſion of features, to which we have aſſociated of notions *gentleneſs, modeſty*, and other female virtues, ſhe inſtantly commands our *eſteem*; and if ſhe have likewiſe ſo much *beauty* as to make her an object of particular *deſire*, eſteem and deſire become ſuddenly combined; and that combination conſtitutes the affection of love. Such, too, is the nature of all mental aſſociations, that each part of which they are compoſed adds ſtrength and vividneſs to the other parts; ſo that, in the preſent inſtance, deſire makes us imagine virtues in the woman which her countenance perhaps does not indicate; and the virtues which are there actually viſible, make us apprehend her beauty as more perfect than it is.

The affection thus generated is more or leſs pure, and will be more or leſs permanent, according as the one or the other part of which it is compounded predominates. "Where deſire of poſſeſſion || prevails over our eſteem of the perſon and merits of the deſirable object, love loſes its benevolent character: the appetite for gratification becomes ungovernable, and tends violently to its end, regardleſs of the miſery that muſt follow. In that ſtate love is no longer a ſweet agreeable affection; it becomes a ſelfiſh, painful paſſion, which like hunger and thirſt, produceth no happineſs but in the inſtant of fruition; and when fruition is over, diſguſt and averſion generally ſucceed to deſire. On the other hand, where eſteem, founded on a virtuous character and gentle manners, prevails over animal deſire, the lover would not for the world gratify his appetite at the expence of his miſtreſs's honour or peace of mind. He wiſhes, indeed, for enjoyment; and to him enjoyment is more exquiſite than to the mere ſenſual lover, becauſe it unites ſentiment with the gratification of ſenſe; at the ſame time that, ſo far from being ſucceeded by diſguſt or averſion, it increaſes his benevolence to the woman, whoſe character and manners he eſteems, and who has contributed ſo much to his pleaſure. Benevolence to an individual, having a general end, admits of acts without number and is ſeldom fully accompliſhed. Hence mutual love, which is compoſed chiefly of eſteem and benevolence, can hardly be of a ſhorter duration than its objects. Frequent enjoyment endears ſuch lovers to each other, and makes conſtancy a pleaſure; and when the days of ſenſual enjoyment are over, eſteem and benevolence will remain in the mind, making ſweet, even in the old age, the ſociety of that pair, in whom are collected the affections of huſband, wife, lover, friend, the tendereſt affections of human nature."

|| *Sketches of Man.*

From the whole of this inveſtigation, we think it appears, that the affection between the ſexes which deſerves the name of *love*, is inſeparably connected with virtue and delicacy; that a man of looſe morals cannot be a faithful or a generous lover; that in the breaſt of him who has ranged from woman to woman for the mere gratification of his ſenſual appetite, deſire muſt have effaced all eſteem for the female character; and that, therefore, the maxim too generally received, "that a reformed rake makes the beſt huſband," has very ſeldom a *chance* to be true. We think it may likewiſe be inferred; that thouſands fancy themſelves in love who know not what love is, or how it is generated in the human breaſt: and therefore we beg leave to adviſe ſuch of our readers as may imagine themſelves to be in that ſtate, to examine their own minds, with a view to diſcover, whether, if the objects of their love were old or ugly, they would ſtill eſteem them for the virtues of their character, and the propriety of their manners. This is a queſtion which deſerves to be well weighed by the young and the amorous, who, in forming the matrimonial connection are too often blindly impelled by mere animal deſire inflamed by beauty, "It may indeed happen ‡, after the pleaſure of gratifying that deſire is gone and if not refined by eſteem and benevolence, go it muſt with a ſwift pace), that a new bond of attachment may be formed upon more dignified and more laſting principles; but this is a dangerous experiment. Even ſuppoſing good ſenſe, good temper, and internal worth of every ſort, yet a new attachment upon ſuch qualifications is rarely formed; becauſe it *commonly*, or rather *always*, happens, that ſuch qualifications, the only ſolid foundation of an indiſſoluble connection, if they did not originally make eſteem predominate over animal deſire, are afterwards rendered altogether inviſible by ſatiety of enjoyment creating diſguſt."

Love, in medicine. The ſymptoms produced by this paſſion as a diſeaſe, according to medical writers, are as follow: The eye-lids often twinkle; the eyes are hollow, and yet appear as if full with pleaſure: the pulſe is not peculiar to the paſſion, but the ſame with that which attends ſolicitude and care. When the object of this affection is thought of, particularly if the idea is ſudden, the ſpirits are confuſed, the pulſe changes, and its force and time are very variable; in ſome inſtances, the perſon is ſad and watchful; in others, the perſon, not being conſcious of his ſtate, pines away, is ſlothful, and regardleſs of food, though the wiſer, when they find themſelves in love, ſeek pleaſant company and active entertainments. As the force of love prevails, ſighs grow deeper; a tremor affects the heart and pulſe; the countenance is alternately pale and red; the voice is ſuppreſſed in the fauces; the eyes grow dim; cold ſweats break out; ſleep abſents itſelf, at leaſt until the morning; the ſecretions become diſturbed; and a loſs of appetite, a hectic fever, melancholy, or perhaps madneſs, if not death, conſtitutes the ſad cataſtrophe. On this ſubject the curious may conſult Ægineta, lib. iii. cap. 17. Oribat. Synop. lib. viii. cap. 9. or a treatiſe profeſſedly written on love, as a diſtemper, by James Ferrard, Oxford, printed 1640.

The manner of the Greeks and Romans were ſimilar to each other in the affairs of love. They generally made a diſcovery of their paſſion, by writing upon trees, walls, doors, &c. the name of their beloved. They uſually decked the door of their dulcinea with flowers and garlands, made libations of wine before their houſes, ſprinkling the poſts with the ſame liquor, as if the object of their affection was a real goddeſs. For a man's garland to be untied, and for a woman to compoſe a garland, were held to be indubitable indications of their love.

When their love was without ſucceſs, they uſed ſeveral arts to excite affection in the object of their deſire. They had recourſe to inchantreſſes, of whom the Theſſalian were in the higheſt eſtimation.—The means made uſe of were moſt commonly philtres or love potions, the operation of which was violent and dangerous, and frequently deprived ſuch as drank them of their reaſon. Some of the moſt remarkable ingredients of which they were compoſed were theſe: the hippomanes, the jynx, inſects bred from putrefaction, the fiſh remora, the lizard, brains of a calf, the hairs on the tip of a wolf's tail, his ſecret parts, the bones of the left ſide of a toad eaten with ants, the blood of doves, bones of ſnakes, feathers of ſcritch-owls, twiſted cords of wool in which a perſon had hanged himſelf, rags, torches, reliques, a neſt of ſwallows buried and famiſhed in the earth, bones ſnatched from hungry bitches, the marrow of a boy famiſhed in the midſt of plenty, dried human liver; to theſe may be added ſeveral herbs growing out of putrid ſubſtances. Such were the ingredients that entered into the compoſition of that infernal draught a *love potion*.

But, beſides the philtres, various other arts were uſed to excite love, in which the application of certain ſubſtances was to have a magical influence on the perſon againſt whom they levelled their ſkill. A hyæna's udder worn under the left arm, they fancied would draw the affections of whatever woman they fixed their eyes upon. That ſpecies of olives called *πετυρα*, and barley-bran made up into a paſte, and thrown into the fire, they thought would excite the flame of love. Flour was uſed with the ſame intention. Burning laurel, and melting wax, were ſuppoſed to have the like effect. When one heart was to be hardened, and another mollified, clay and wax, were expoſed to the ſame fire together. Images of wax were frequently uſed, repreſenting the perſons on whom they wiſhed to make an impreſſion; and whatever was done to the ſubſtitute of wax, they imagined was felt by the perſon repreſented. Enchanted medicaments were often ſprinkled on ſome part of the houſe where the perſon reſided. Love-pledges were ſuppoſed to be of ſingular uſe and efficacy: theſe they placed under their threſhold, to preſerve the affections of the owner from wandering. Love-knots were of ſingular power, and the number three was particularly obſerved in all they did. But no good effect was expected, if the uſe of theſe things was not attended with charms or magical verſes and forms of words. See Magic.

Having mentioned their arts of exciting love, it may not be amiſs to take notice, that, the ancients imagined, that love excited by magic might be allayed by more powerful ſpells and medicaments, or by applying to demons more powerful than thoſe who had been concerned in raiſing that paſſion. But love inſpired without magic had no cure; Apollo himſelf could find no remedy, but cried out

Hei mihi quod nullis amor eſt medicabilis herbis.

The antidotes againſt love were generally *agnus caſtus*, which has the power of weakening the generative faculty; ſprinkling the duſt in which a mule had rolled herſelf; tying toads in the hide of a beaſt newly ſlain; applying amulets of minerals or herbs, which were ſuppoſed of great efficacy in other caſes; and invoking the aſſiſtance of the infernal deities. Another cure for love was bathing in the waters of the river Selemnus; to which we may added the lover's leap, or jumping down from the Lecadian promontory.

Love-Apple. See Solanum.

LOVENTINUM, or Luentinum, (anc. geog.) a town of the Demeta in Britain, near the mouth of the Tuerobis or Tivy. Suppoſed to have been after-

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‡ Elements of Criticiſm.

wards ſwallowed up by an earthquake, and to have ſtood where is now the lake called *Lin Savatan* in Brecknockſhire.

LOUGHBOROUGH, a town of Leiceſterſhire in England, 110 miles from London. It is the ſecond town in the county, and was in the Saxons time a royal village. Its market is on Thurſday; and its fairs are on April 25th, May 28th, Auguſt 1ſt, and November 2d. It has a large church, and a free ſchool; beſides a charity ſchool for 80 boys and another for 20 girls. It has been very much reduced by fires; but is ſtill a very agreeable town, with rich meadow-ground, on the Foſſe, which runs here almoſt parallel with the river Soar. The New canal has made the coal-trade here very extenſive.

LOUGHBRICKLAND, a fair and poſt town of Ireland, ſituated in the county of Down, and province of Ulſter, 58 miles from Dublin. The name ſignifies the lake of the *ſpeckled trouts*; and it was ſo called from a lake near it, which abounds with thoſe fiſh. It conſiſts of one broad ſtreet, at the end of which is the pariſh-church, ſaid to have been built by Dr Taylor when biſhop of Dromore, ſoon after the Reſtoration. The linen manufacture is carried on here very extenſively: and the town is a great thoroughfare, the turnpike road from Dublin to Belfaſt paſſing through a red bog near it. The fairs are five in the year.

LOGH-DERGH, anciently *Derg-abhan*, i. e. "the river of the woody moraſs," from a river which iſſues out of this lake. This lough is ſituated in the county of Donegal and province of Ulſter in Ireland, and is famous for having in it the iſland that contains St Patrick's purgatory, which is a narrow little cell, hewn out of the ſolid rock, in which a man could ſcarce ſtand upright.—There is alſo a lake of this name ſituated between the counties of Galway and Tipperary.

LOUCH-NEACH, a loch or lake of Ireland, ſituated in the counties of Armagh, Down, Derry; and Antrim, and province of Ulſter, It is the largeſt in Europe, thoſe of Ladoga and Onega in Ruſſia, and that of Geneva in Switzerland, excepted; being 20 miles long and 15 broad. The area of this lake is computed to be 100,000 acres. It is remarkable for a healing virtue; and likewiſe for petrifying wood, which is not only found in the water, but in the adjacent ſoil at a conſiderable depth. On its ſhore ſeveral beautiful gems have been diſcovered. Its ancient name was *Loch-eacha* or *Loch-Neach* from *loch*, "a lake," and *Neach*, "wonderful, divine, or eminent." Its petrifying powers are not inſtantaneous, as ſeveral of the ancients have ſuppoſed, but require a long ſeries of ages to bring them to perfection, and appear to be occaſioned by a fine mud or ſand, which inſinuates itſelf into the pores of the wood, and which in proceſs of time becomes hard like ſtone. On the borders of this lake is Slane's caſtle, the elegant ſeat of the right honourable John O'Neil. Dr Smyth ſeems to doubt whether the healing quality in this lake is not to be confined to one ſide of it, called the *fiſhing bank*; and he informs us, that this virtue was diſcovered in the reign of Charles II. in the inſtance of the ſon of one Mr Cunningham, who had an *evil* which run on him in eight or ten places; and notwithſtanding all applications ſeemed incurable, at length he was perfectly healed, after bathing in this lough about eight days. Hence that writer gives us another derivation of the name *Lochneach*, which (he ſays) ſeems to hint at the quality; *Neaſg* or *Neas*, in Iriſh, ſignifying a ſore or ulcer," which might not improbably be corrupted into *Neagh*: Hence he apprehends this lake was remarked at a much earlier period for its healing property. As to its petrifying power, it is mentioned by Nenius, a writer at the ninth century, who ſays, "Eſt aliud ſtagnum quod facit ligna dureſcere in lapides. Homines autem findunt ligna, et poſt quam formaverunt, projiciunt in ſtagnum, et manent in eo uſque ad caput anni, et in capite anni lapis invenitur, et vocatur ſtagnum *Luch-Echach*." Lough-Neach gives title of baron to the family of *Skeffington*.

LOUGH-STRANGFORD, a lake of Ireland, ſituated in the county of Down and province of Ulſter. It takes its preſent name from a ſmall port-town called *Strangford*, ſeated on the weſt ſide of the narrow entrance into the ſea. It was formerly known by the name *Lough-Cone* or *Lough-Coyne*. It is a deep bay or inlet of the ſea, about 17 miles long and four or five broad; it goes weſt as far as Downpatrick, and north as far as Comber and Newtown, and by computation covers 25,775 acres, Iriſh plantation meaſure. It abounds with excellent fiſh, particularly ſmelts: and off the bar there is a periodical herring fiſhery in or about Auguſt. The bar or entrance into this lough is about three miles below Strangford. There is a long rock at the entrance in the middle of the paſſage, dangerous to ſtrangers on account of the current; yet there is a broad paſſage on either ſide, and deep water. The current here is very ſtrong and rapid, running at the rate of ſix or ſeven miles an hour. There are but few veſſels that go higher up than Strangford. A good many veſſels bound up the channel put in here, if the wind is unfavourable to their paſſage. The iſlands of this lake are numerous; Doctor Boat enumerates them at 260. But from an actual ſurvey, made at the time Dr Smith wrote his hiſtory of that county, it appears, there are 54 iſlands ſmall and great, known by particular names, and many others nameleſs; the contents of theſe 54 iſlands added together amount to 954 acres and an half. The great and profitable manufacture carried on in theſe iſlands, and the flat ſtony coaſts ſurrounding the lake, is the burning of ſea-weed into kelp, which employs a number of hands, and has been computed to produce to the ſeveral proprietors a neat profit of 1000l. *per annum* and upwards. Four of the iſlands here are called *Swan Iſlands*, from the number of ſwans that frequent them.

LOUIS, or *Knights of* St Louis, the name of a military order in France, inſtituted by Louis XIV. in 1693. Their colars are of a flame colour, and paſs from left to right: the king is their grand maſter. There are in it eight great croſſes, and 24 commanders; the number of knights is not limited. At the time of their inſtitution, the king charged his revenue with a fund of 300,000 livres for the penſions of the commanders and knights.

Louis, *Lewis, Lous d'or*, or *Lewidore*, a French coin, firſt ſtruck in 1640, under the reign of Louis XIII. and which has now a conſiderable currency. See MONEY-*Table*.

LOUISIANA, a country in North-America, bounded on the ſouth by the gulph of Mexico, on the eaſt by the river Miſſiſippi, on the weſt by New Mexico, and on the north by an unknown country. It extends from the 29th to the 40th degree of north latitude, and from about the 80th to the 96th or 97th degree weſt longitude from London. The climate of Louiſiana varies according to the latitudes. The ſouthern parts are not ſo hot as thoſe parts of Africa which lie under the ſame parallel, and the northern parts are colder than the countries of Europe at the ſame diſtance from the pole: the cauſes of which are ſuppoſed to be the thick foreſts which over-run the country, and the great nuber of rivers; the former preventing the ſun from heating the earth, and the latter ſupplying it with moiſt vapours: beſides the cold winds which come from the north over vaſt tracts of land. They have bad weather but it never laſts long, for the rain generally falls in ſtorms and ſudden ſhowers; the air is wholeſome, the inhabitants healthy, and they who are temperate live to a great old age. The country is extremely well watered; and almoſt all the rivers that run through it fall into the Miſſiſippi, which diſcharges itſelf into the gulph of Florida.

LOUSE, in zoology. See PEDICULUS and LICE

LOUSY DISEASE. See MEDICINE-*Index*.

LOUTH, a town of Lincolnſhire in England, 156 miles from London. It is a town corporate; and one of the handſomeſt and gayeſt in the county, there being in it not only frequent aſſemblies, concerts, &c. but even maſquerades. Here are ſeveral handſome houſes. From hence there is a canal to the ſea at Tilney, about eight miles. Beſides a charity ſchool for 40 children, it has a free ſchool founded by Edward VI. with a large church, and a fine ſteeple, which ſome think is as high as Grantham ſpire which is 288 feet high. Its markets are on Wedneſday and Saturday, and its fairs on May 24th, and Auguſt 16th.

LOUTH, a county in the eaſtern part of Ireland, which extends in the form of a bow or half-moon, on the ſide of the ocean, being much longer than it is broad: it is bounded on the ſouth and ſouth-weſt by the county of Eaſt-Meath, on the north-weſt by Monaghan, on the north by Armagh, and on the north-eaſt by the bay of Carlingford, which parts it from the county of Down; it is watered by ſeveral ſmall rivers which fall into the ſea; and its ſouth frontiers are watered by the river Boyne. Its chief towns are Dundalk and Carlingford; unleſs we include Drogheda, a part whereof is in this county. It is the ſmalleſt county in the kingdom but very fertile and pleaſant and abounding with many remains of antiquities, of which Mr Wright, in his Louthiana, has given a very ample deſcription. It contains 111, 180 Iriſh plantation acres, 50 pariſhes, 5 baronies, and 5 boroughs, and returns 10 members to parliament; it is about 22 miles long and 14 broad.

LOUTH, a town in the above county, having a yearly fair.

LOUVAIN, a city in the Auſtrian Netherlands, in the province of Brabant, pleaſantly ſeated on the river Dyle, in a plentiful and agreeable country. The walls are about eight or nine miles in circumference; but they include ſeveral fields and vineyards. The caſtle ſtands on a high hill, ſurrounded with fine gardens, and has a charming proſpect all over the country. This town contains nine market places, 14 water-mills, 126 ſtreets, 16 ſtone bridges, and ſeveral handſome palaces. The town-houſe is a venerable old building, adorned with ſtatues on the outſide; and the churches are very handſome, particularly the collegiate church of St Peter, but the principal ornament is the univerſity, founded only in 1426 by John IV. duke of Brabant, with the concurrence of Pope Martin V. It contains about 40 colleges, four of which are called *Pedagogia*. There is in the number alſo an Engliſh college of friars, preachers, which owes its eſtabliſhment to the liberalities of Cardinal Philip Howard, brother to the duke of Norfolk, who, before he was raiſed to the purple had been private chaplain to Queen Catherine, conſort to Charles II. The Iriſh have likewiſe a ſeminary, erected in part under the care of Eugenius Mattheus, titular archbiſhop of Dublin, anno 1623, which receives its appointments from the propaganda at Rome Beſides the above, there are two convents for the Iriſh, one of Recollects and the other of Dominicans, where divinity and the Matheſis are taught. In the laſt century the number of ſcholars exceeded 4000, but in the year 1743 the inhabitants amounted to 12,000, including 2000 ſtudents only.—At the beginning of the 14th century, under John III. it flouriſhed conſiderably in the manufacture of woollen cloth: 400 houſes were then occupied by ſubſtantial clothiers, who gave employment to an incredible number of weavers, ſo great it is ſaid, that a bell was rung to prevent any injuries which the children in the ſtreet might receive from the crowd and hurry on their returning from work. In 1382, theſe weavers, however, took up arms, and rebelled againſt their ſovereign Prince Wenceſlaus, throwing from the windows of the Town-hall 17 of the aldermen and counſellors; and afterwards proceeded to lay waſte great part of Brabant: but being beſieged and reduced to great extremities, they ſubmiſſively implored his clemency: which was granted after the execution of ſome of the principal ringleaders. The weavers, the chief inſtigators to this revolt, were baniſhed, the greater part of whom took refuge in England; where they firſt introduced, or at leaſt augmented very much, the woollen manufacture. The town, by this circumſtance, being almoſt depopulated, the univerſity was eſtabliſhed to ſupply in ſome meaſure the loſs of the rebellious clothiers. Since that time the manufacture gradually declined, no cloth of any account being made there at preſent. This impolitic ſtep of the Duke Wenceſlaus ſent treaſures to England, through the hands of thoſe exiled people; an important leſſon to governors, that they ſhould deal with great precaution reſpecting ſuch uſeful members of the community. Upon the ruins of theſe looms was formed the cloth manufacture of Limbourg, which is carried on with good advantage to this day. There is yet ſtanding at Louvain part of the old drapers-hall, now converted into four public ſchools, where lectures in divinity, philoſophy, law, and phyſic, are given and the public acts are made. Adjoining to the ſchools is the univerſity library, which altogether compoſe a large pile of building. Over the door of the chief entrance we read theſe words, *Sapientia ædificavit ſibi domum*. The principal church is collegiate, dedicated to

St Peter, which had formerly three very large towers with elevated ſpires, one conſiderably higher than the two collaterals; theſe were blown down in the year recorded by this chronogram, *o MnIa CaDVnt*. From the name of this church the burghers have acquired the nick-name of *Petermen*, whoſe anceſtors having cloathed the back by a noble woollen manufacture, the modern Petermen now compoſe an ignoble mixture for the belly, called after them, *Peterman beer*, a ſort of whitiſh muddy ale, which they notwithſtanding ſend in large quantities to all parts of the country, as well as to Holland, by the canals. Louvain was anciently the capital of the province, long before Bruxelles had any claim to that title. E. Long. 4. 40. N. Lat. 51. 12.

LOUYS, or Louis, (John), an engraver of conſiderable eminence, who flouriſhed about the middle the 56th century. According to Baſan, he was a native of Flanders. He learned the art of engraving from Peter Soutman, at the time that Styderhoef died under the ſame maſter; and his uſual ſtyle of engraving bears ſome reſemblance to that of his maſter's One his beſt prints is, Diana, with her nymphs, repoſing after the chaſe; a middling-ſized plate, lengthwiſe from Rubens

LOW-BELL, in birding, a name given to a bell, by means of which they take birds in the night, in open champaign countries, and among ſtubble, in October. The method is to go out about nine o'clock at night in a ſtill evening, when the air is mild and the ſun does not ſhine. The low-bell ſhould be of a deep and hollow ſound, and of ſuch a ſize that a man may conveniently carry it in one hand. The perſon who carries it is to make it toll all the way he goes, as nearly as may be, in that manner in which the bell on the neck of a ſheep tolls as it goes on and feeds. There muſt alſo be a box made like a large lanthorn, about a foot ſquare, and lined with tin, but with one ſide open. Two or three great lights are to be ſet in this; and the box is to be fixed to the perſon's breaſt, with the open ſide forwards, ſo that the light may be caſt forward to a great diſtance. It will ſpread as it goes out of the box; and will diſtinctly ſhow to the perſon that carries it whatever there is in the large ſpace of ground over which it extends, and conſequently all the birds that rooſt upon the ground. Two perſons muſt follow him who carries the box and bell, one on each ſide, ſo as not to be within the reach of the light to ſhow themſelves. Each of theſe is to have a hand-net of about three or four feet ſquare, faſtened to a long ſtick or pole; and on whichever ſide any bird is ſeen at rooſt, the perſon who is neareſt is to lay his net over it, and take it with as little noiſe as poſſible. When the net is over the bird, the perſon who laid it is not to be in a hurry to take the bird, but muſt ſtay till he who carries the light is got beyond it, that the motions may not be diſcovered. The blaze of the light and the noiſe of the bell terrify and amaze the birds in ſuch a manner that they remain ſtill to be taken; but the people who are about the work muſt keep the greateſt quiet and ſtillneſs that may be.

Some people are fond of going on this ſcheme alone. The perſon then fixes the light box to his breaſt and carries the bell in one hand and the net in the other; the net in this caſe may be ſomewhat ſmaller, and the handle ſhorter. When more than one are out at a time, it is always proper to carry a gun; as it is no uncommon thing to ſpy a hare when on this expedition.

LOW (EAST), a town of Cornwall in England, 231 miles from London, in the poſt-road from Plymouth. It is an ancient borough by preſcription, made a corporation by charter of queen Eliſabeth, conſiſting of nine burgeſſes (one of whom is yearly choſen the mayor), a recorder, aldermen, &c.; and the mayor, magiſtrates, and freemen, who are about 68, chooſe the members of parliament. This being a manor of the duchy of Cornwall, was ſettled by king William on lord Somers, and is now held by the corporation at the free-farm rent of 20s. a-year. It is ſeated pretty commodiouſly on a creek of the ſea, over which there is a large ſtone bridge, ſupported by 15 arches, which leads to *Weſt Low*, ſtanding between two hills. The chief benefit which the inhabitants have is in their fiſhery. Here is a battery of four guns, and a ſmall chapel. Its market is on Saturday, and has two fairs in the year.

Low (Weſt), called alſo *Port-Pigham*, a town of Cornwall, divided from Eaſt Low by a ſtone bridge of 15 arches over the river Low, from whence both towns receive their name, as the river does from the lowneſs of its current between its high banks. The corporation, by charter of queen Elizabeth, conſiſts of 12 burgeſſes, one of whom is annually choſen mayor, and, with the other burgeſſes, has power to chooſe a ſteward. Its members, whom it has ſent to parliament ever ſince the 6th of Edward VI. are elected by the corporation and freemen, who are about 60. There was a chapel of eaſe here in the reign of Henry VIII. which was afterwards converted into a town-hall; and the town lying in the pariſh of Talland, the people go thither to church. The market is on Saturday, and fair on April 25. There is a pretty little harbour here; near the mouth of which is a ſmall iſland called St George's, which abounds with ſea-pies. The river here is navigable for veſſels of 1000 tons.

LOWER (Richard), an eminent Engliſh phyſician in the 17th century, was born in Cornwall, and educated at Weſtminſter-ſchool and Oxford. He entered on the phyſic line; and practiſed under Dr Thomas Willis, whom he inſtructed in ſome parts of anatomy, eſpecially when the latter was writing his *Cerebri anatome*. He, with Dr Willis, in 1674, diſcovered the medicinal waters at Aſhop in Northamptonſhire; which, upon their recommendations, became very much frequented. In 1666 he followed Dr Willis to London; practiſed phyſic under him; and became fellow of the royal ſociety, and of the college of phyſicians. In 1669 he publiſhed his *Tractatus de corde*; and, after the death of Dr Willis in 1675, he was eſteemed the moſt eminent phyſician in London. Upon the breaking out of the Popiſh plot in 1678, ſays Mr Wood in his *Athenæ Oxonienſis*, he cloſed with the Whigs, ſuppoſing that party would carry all before them; but, being miſtaken, he loſt his credit and practice. He died in 1691.

LOWERING, among diſtillers, a term uſed to expreſs the debaſing the ſtrength of any ſpirituous liquor, by mixing water with it. The ſtandard and marketable price of theſe liquors is fixed in regard to a certain ſtrength in them called *proof*; this is that ſtrength which makes them, when ſhaken in a phial or poured from on high into a glaſs, retain a froth or crown of bubbles for ſome time. In this ſtate, ſpirits conſiſt of about half pure or totally inflammable ſpirit, and half water; and if any foreign or home ſpirits are to be expoſed to ſale, and are found to have that proof wanting, ſcarce any body will buy it till it has been diſtilled again and brought to that ſtrength; and if it is above that ſtrength, the proprietor uſually adds water to it to bring it down to that ſtandard. See the article Proof.

There is another kind of lowering among the retailers of ſpirituous liquors to the vulgar, by reducing it under the ſtandard proof. Whoever has the art of doing this without deſtroying the bubble proof, which is eaſily done by means of ſome addition that gives a greater tenacity to the parts of the ſpirits, will deceive all that judge by this proof alone. In this caſe, the beſt way to judge of liquors is by the eye and tongue, and eſpecially by the inſtrument called Hydrometer.

LOWTH (William), D.D. a learned divine, born at London in 1661, was the ſon of an apothecary, and took his degrees at Oxford. His eminent worth and learning recommended him to Dr Mew biſhop of Wincheſter, who made him his chaplain, gave him two livings in Hampſhire, and conferred on him a prebend in the cathedral of Wincheſter. He acquired an unuſual ſhare of critical learning. Thus ſituated in life, the labours of Mr Lowth appear to have been ſtrictly confined within the limits of his own province, and applied ſolely to the peculiar duties of his own function: yet, in order that he might acquit himſelf the better in theology, he had purſued his ſtudies with a more general and extenſive view. Few were more deeply verſed in critical learning; there being ſcarcely any ancient author, Greek or Latin, profane or eccleſiaſtical, eſpecially the latter, but what he had read with accuracy, conſtantly accompanying his reading with critical and philological remarks. Of his collections in this way he was upon all occaſions very communicative. Hence his notes on *Clemens Alexandrinus*, which are to be met with in Potter's edition of that father. Hence his remarks on *Joſephus*, communicated to Hudſon for his edition, and acknowledged in the preface; as alſo thoſe larger and more numerous annotations on the Eccleſiaſtical Hiſtorians, inſerted in *Reading's* edition of them at Cambridge. The author of *Bibliotheca Biblica* was indebted to him for the ſame kind of aſſiſtance. Chandler, late biſhop of Durham, while engaged in his "Defence of Chriſtianity, from the Prophecies of the Old Teſtament, againſt the Diſcourſe of the Grounds and Reaſons of the Chriſtian religion," and in his "Vindication of the Defence, in anſwer to the Scheme of Literal Prophecy conſidered," held a conſtant correſpondence with him, and conſulted him upon many difficulties that occurred in the courſe of that work. The moſt valuable part of his character was that which leaſt appeared in the eyes of the world, the private and retired part, that of the good Chriſtian and the uſeful pariſh-prieſt. His piety, his diligence, his hoſpitality and beneficence, rendered his life highly exemplary, and greatly enforced his public exhortations. He married Margaret, daughter of Robert Pitt, Eſq; of Blandford, by whom he had two ſons and three daughters. (ſee the next article.) He died in 1732, and was buried by his own orders in the church-yard at Buriton. He publiſhed, 1. A vindication of the divine authority and inſpiration of the Old and New Teſtaments; 2. Directions for the profitable reading of the Holy Scripture; 3. Commentaries on the prophets: and other works.

Lowth (Robert), D. D. ſecond ſon of the preceding Dr William Lowth, and biſhop ſucceſſively of St David's, Oxford, and London was born on the 29th of November 1710, probably at Buriton in the county of Hants. He received the rudiments of his education in Wincheſter college, where his ſchool exerciſes were diſtinguiſhed by uncommon elegance; and having reſided the requiſite number of years in that ſeminary, in 1730 he ſucceeded on the foundation at New College, Oxford. He took the degree of M. A. June 8. 1737. Though his abilities muſt have been known to thoſe with whom he was connected, he was not forward to appear before the world as a writer. At Oxford he continued many years improving his talents, with little notice from the great, and with preferment ſo ſmall as to have at preſent eſcaped the diſtinct recollection of ſome of his contemporaries.

He was not, however, ſuffered to languiſh for ever in obſcurity. His genius and his learning forced themſelves upon the notice of the illuſtrious ſociety of which he was a member; and he was placed in a ſtation where he was eminently qualified to ſhine. In 1741 he was elected by the univerſity to the profeſſorſhip of poetry, re-elected in 1743, and whilſt he held that office he read his admirable lectures *De ſacra poeſi Hebræorum*. In 1744 Biſhop Hoadley collated him to the rectory of Ovington in the county of Hants; added to it, nine years afterwards, the rectory of Eaſt Weedhay in the ſame county; and in the interim raiſed him to the dignity of archdeacon of Wincheſter. Theſe repeated favours he ſome years afterwards acknowledged in the following manly and reſpectful terms of gratitude: "This addreſs, My Lord, is not more neceſſary on account of the ſubject, than it is in reſpect of the author. Your Lordſhip unſolicited and unaſked, called him from one of thoſe colleges to a ſtation of the firſt dignity in your dioceſe, and took the earlieſt opportunity of accumulating your favour upon him, and adding to that dignity a ſuitable ſupport. Theſe obligations he is now the more ready thus publicly to acknowledge, as he is removed out of the reach of further favours of the like kind. And though he hath relinquiſhed the advantages ſo generouſly conferred on him, yet he ſhall always eſteem himſelf highly honoured in having once enjoyed the patronage of the great advocate of civil and religious liberty."

On the 8th of July 1754 the univerſity of Oxford conferred upon him the degree of D. D. by diploma; an honour which, as it is never granted but to diſtinguiſhed merit, was probably conferred on Mr Lowth in conſequence of his prelections on the Hebrew poetry, which had then been lately publiſhed. Having in 1749 travelled with Lord George and Lord Frederick Cavendiſh, he had a claim upon the patronage of the

Devonſhire family; and in 1755, the late duke being then lord lieutenant of Ireland, Dr Lowth went to that kingdom as his grace's firſt chaplain. Soon after this appointment he was offered the Biſhopric of Limerick; but preferring a leſs dignified ſtation in his own country, he exchanged it with Dr Leſlie, prebendary of Durham and rector of Segdefield, for theſe preferments. In November 1765 he was choſen F.R.S. In June 1766 he was, on the death of Dr Squire, preferred to the biſhopric of St David's; which, in the October following, he reſigned for that of Oxford, vacant by the tranſlation of biſhop Hume to Saliſbury. In April 1777, he was tranſlated to the ſee of London, vacant by the death of Biſhop Terrick; and in 1783 he declined the offer of the primacy of all England.

Having been long aflicted with the ſtone, and having long borne the ſevereſt ſufferings of pain and ſickneſs with the moſt exemplary fortitude and reſignation, this great and good man died at Fulham Nov. 3, 1787; and on the 12th his remains were privately interred in a vault at Fulham church, near thoſe of his predeceſſor. He had married in 1752, Mary, the daughter of Laurence Jackſon of Chriſt-church, Hants, Eſq; by whom he had two ſons and five daughters. His lady and two children only ſurvived him.

His literary character may be eſtimated from the value and the importance of his works; in the account of which we may begin with his *Prelections on the Hebrew Poetry*. The choice of ſo intereſting a ſubject naturally attracted general attention, and the work has been read with equal applauſe abroad and at home. In theſe prelections the author has acquitted himſelf in the moſt maſterly manner, as a poet, a critic, and a divine; and ſuch is the claſſic purity of his Latin ſtyle, that though we have read the work with the cloſeſt attention, and with no other view than to diſcover, if poſſible, an Angliciſm in the compoſition, we never found a ſingle phraſe to which, we believe, a critic of the Auguſtan age could poſſibly have objected. This is an excellence to which neither Milton nor Johnſon has attained; to which indeed no other Engliſh writer of Latin with whom we are acquainted has attained, unleſs perhaps Atterbury muſt be excepted. To the prelections was ſubjoined a ſhort confutation of biſhop Hare's ſyſtem of Hebrew metre: which occaſioned a Latin letter from Dr Edwards of Clare-hall, Cambridge, to Dr Lowth, in vindication of the Harian metre. To this the author of the prelections replied in a *larger confutation*, in which biſhop Hare's ſyſtem is completely overthrown, and the fallacy upon which it was built accurately inveſtigated. After much attentive conſideration, biſhop Lowth has pronounced the metre of the Hebrew to be perfectly irrecoverable.

In 1758 he publiſhed *The life of William of Wykeham, biſhop of Wincheſter*, with a dedication to Biſhop Hoadley, which involved him in a diſpute concerning a deciſion which that biſhop had lately made reſpecting the wardenſhip of Wincheſter-college. This controverſy was on both ſides carried on with ſuch abilities, that, though relating to a private concern, it may yet be read, if not with pleaſure at leaſt with improvement. The life of Wykeham is drawn from the moſt authentic ſources; and affords much information concerning the manners, and ſome of the public tranſactions of the period in which Wykeham lived, whilſt it diſplays ſome private intelligence reſpecting the two literary ſocieties of which he was the founder. In theſe two ſocieties Dr Lowth was educated, and he gratefully expreſſes his obligations to them.

In 1762 was firſt publiſhed his *Short Introduction to Engliſh Grammar*, which has ſince gone through many editions. It was originally deſigned only for private and domeſtic uſe; but its judicious remarks being too valuable to be confined to a few, the book was given to the world; and the excellence of its method, which teaches what is right by ſhowing what is wrong, has inſured public approbation and very general uſe. In 1765 Dr Lowth was engaged with biſhop Warburton in a controverſy, which made much noiſe at the time, which attracted the notice even of royalty, and of which the memory is ſtill recent. If we do not wiſh to dwell on the particulars of this controverſy, it is becauſe violent literary contention is an evil, which though like other war it may ſometimes be unavoidable, is yet always to be regretted; and becauſe the characters of learned, ingenious, and amiable men, never appear to leſs advantage than under the form which that ſtate of hoſtility obliges them to aſſume. The two combatants indeed engaged with erudition and ingenuity ſuch as is ſeldom brought into conflict; but it appears that, in the opinion of Dr Johnſon, Warburton had the moſt ſcholaſtic learning, and that Lowth was the moſt correct ſcholar; that, in their conteſt with each other, neither of them had much argument, and that both were extremely abuſive. We have heard, and we hope it is true, that they were afterwards reconciled, and Expreſſed mutual regret for the violence of their paſt conduct.

In 1778 Biſhop Lowth publiſhed his laſt great work, *A Tranſlation of Iſaiah*. To his literary and theological abilities, the tranſlator joined the moſt critical knowledge of the character and ſpirit of the eaſtern poetry; and, accordingly, the prophecies of Iſaiah (which, though almoſt always ſublime or elegant, are yet ſometimes obſcure) were tranſlated in a manner adequate to the higheſt expectations of the public. Several occaſional diſcourſes, which the Biſhop, by his ſtation, was at different times called upon to deliver, were of courſe publiſhed, and are all worthy of their excellent author; but there is one on the *kingdom of God*, on the extenſion and progreſſive improvement of Chriſt's religion and on the means of promoting theſe by the advancement of religious knowledge, by freedom of inquiry, by toleration, and mutual charity, which may be diſtinguiſhed above the reſt, as exhibiting a moſt comprehenſive view of the ſucceſſive ſtates of the Chriſtian church, and containing the trueſt principles of Chriſtianity.

Of the Biſhop's poetical pieces, none diſplay greater merit than *Verſes on the Genealogy of Chriſt*, and *the Choice of Hercules*, both written very early in his life. He wrote a ſpirited *Imitation of an Ode of Horace*, applied to the alarming ſituation of this country in 1745; and likewiſe ſome *verſes on the death of Frederic prince of Wales*, with a few ſmaller poems. The following inſcription on the tomb of his daughter, beautifully diſplays his paternal affection and claſſic taſte. As it is ſhort, and, in our opinion, has all the merit of the ancient epitaph, the reader will probably be pleaſed with ſuch a ſpecimen of his lordſhip's Latinity.

Cara, vale, ingenio præſtans, pietate, pudore,
Et pluſquam natæ nomine cara, vale.
Cara Maria, vale. At veniet felicius ævum,
Quando iterum tecum, ſi modo dignus, ero.
Cara, redi, læta tum dicam voce, paternas.
Eja, age in amplexus, cara Maria, redi.

Learning and taſte, however, did not conſtitute Biſhop Lowth's higheſt excellence. Eulogium itſelf can ſcarcely aſcend to extravagance when ſpeaking of him either as a private man or as a paſtor of the church of Chriſt. His amiable manners rendered him an ornament to his high ſtation, whilſt they endeared him to all with whom he converſed; and his zeal for the intereſts of true religion made him eager to promote to places of truſt and dignity ſuch clergymen as he knew were beſt qualified to fill them. Of his modeſty, gentleneſs, and pleaſing converſation, we have the teſtimony of one whoſe deciſion will hardly be diſputed.—"It would anſwer no end (ſays Biſhop Warburton) to tell you what I thought of the author of Hebrew poetry, before I ſaw him. But this I may ſay, I was never more ſurpriſed, when I did ſee him, than to find him of ſuch amiable and gentle manners, of ſo modeſt, ſenſible, and diſengaged a deportment." He united, indeed, in an eminent degree, the qualities of the gentleman with thoſe of the ſcholar: he converſed with elegance, as he wrote with accuracy. As a huſband, a father, or the maſter of a family, he was as nearly faultleſs as the imperfections of humanity will eaſily permit. His temper, when rouſed by what he thought improper conduct, was indeed ſuſceptible of conſiderable warmth; but if he could be highly offended, upon a ſlight conceſſion he could likewiſe forgive. His heart was tender and ſympathetic. He poſſeſſed a mind which felt its own ſtrength, and decided on whatever came before it with promptitude and firmneſs. In thoſe trials where affliction was to be ſuffered or ſubdued, he behaved as a man and a Chriſtian. His piety had no tincture of moroſeneſs; his charity no leaven of oſtentation. To his whole dioceſe he was endeared by his laudable diſcretion and his uſeful zeal. To the world he was a benefit by his exemplary life and his ſplendid abilities. And whilſt virtue and learning are reverenced among men, the memory of LOWTH will be reſpected and admired.

LOXIA, in zoology; the name of a genus of birds of the order of paſſeres, the diſtinguiſhing characters of which are theſe: The bill is ſtrong convex above and below, and very thick at the baſe: the noſtrils are ſmall and round: the tongue is as if cut off at the end: the toes are four, placed three before and one behind; excepting in one ſpecies, which has only two toes before and one behind.

1. The curviroſtra, or common croſs-bill, which is about the ſize of a lark, is known by the ſingularity of its bill, both mandibles of which curve oppoſite ways and croſs each other: The general colour of the plumage in the male is of a red-lead inclining to roſe-colour, and more or leſs mixed with brown: the wings and tail are brown; the legs black. The female is of a green colour, more or leſs mixed with brown in thoſe parts where the male is red. This ſpecies is a conſtant inhabitant of Sweden, Germany, Poland, Switzerland, Ruſſia, and Siberia, where it breeds; but migrates ſometimes in vaſt flocks into other countries, as is now and then the caſe in reſpect to England; for though in ſome years a few are met with, yet in others it has been known to viſit there by thouſands, fixing on ſuch ſpots as are planted with pines, for the ſake of the ſeeds, which are its natural food: it is obſerved to hold the cone in one claw like the parrot, and to have all the actions of that bird when kept in a cage. It is alſo found in North America and Greenland; and is ſaid to make the neſt in the higheſt parts of the fir-trees, faſtening it to the branch with the reſinous matter which exſudes from the trees.

2. The coccothrauſtes, or hawfinch, is in length ſeven inches; breadth, 13: the bill is funnel-ſhaped, ſtrong, thick, and of a dull pale pink colour; the breaſt and whole under ſide are of a dirty fleſh colour; and neck aſh coloured; the back and coverts of the wings of a deep brown, thoſe of the tail of a yellowiſh bay: the greater quill-feathers are black, marked with white on their inner webs: the tail is ſhort, ſpotted with white on the inner ſides; and the legs are of a fleſh-colour. This ſpecies is ranked among the Britiſh birds; but only viſits theſe kingdoms occaſionally, and for the moſt part in winter, and never known to breed there. It is more plenty in France, coming into Burgundy in ſmall flocks, about the beginning of April; and ſoon after making the neſt, which is placed between the bifurcation of the branches of trees, about twelve feet from the ground: it is compoſed of ſmall dry fibres, intermixed with liverwort, and lined with finer materials. The eggs are of a roundiſh ſhape, of a bluiſh green, ſpotted with olive brown, with a few irregular black markings interſperſed. It is alſo common in Italy, Germany, Sweden, and the weſt and ſouthern parts of Ruſſia, where the wild fruits grow. It feeds on berries, kernels, &c. and from the great ſtrength of the bill, it cracks the ſtones of the fruit of the haws, cherries, &c. with the greateſt eaſe.

3. The enucleator, or pine-groſsbeak, is nine inches in length, and weighs two ounces. The bill is ſtrong, duſky, and forked at the end; the head, back, neck, and breaſt are of a rich crimſon; the bottoms of the feathers aſh-colour; the quill-feathers and tail duſky, their exterior edges of a dirty white: the legs are black. This ſpecies frequents the moſt northern parts of England, being only met with in Scotland, and eſpecially the Highlands, where it breeds, and inhabits the pine-foreſts, feeding on the ſeeds, like the croſs-bill. It is alſo found in all the pine-foreſts of Siberia, Lapland, and the northern parts of Ruſſia: it is common about St Peterſburgh in autumn, and is caught in great plenty at that time for the uſe of the table; returning north in ſpring. They are likewiſe common to the northern parts of America; appearing at Hudſon's Bay in May, to which place they are ſaid to come from the ſouth, and are obſerved to feed on the buds of willow. The ſouthern ſettlements are inhabited by them throughout the year, but the northern only in the ſummer ſeaſon. Our laſt voyagers met with this bird in Norton Sound; it was alſo found at Aoonalaſhka.

4. The pyrrhula, or bullfinch, is ſo generally known

as almoſt to ſuperſede deſcription : The head, wings, and tail, are black ; the breaſt and belly red ; the upper tail coverts and vent white ; and the breaſt aſh-colour. The female differs in having the under parts of a reddiſh brown. This ſpecies is common in moſt parts of the continent of Europe, and throughout Ruſſia and Siberia, at which laſt places it is caught for the table. It is pretty common in England ; and builds in the buſhes, five or ſix feet from the ground. The neſt is compoſed chiefly of moſs ; and the eggs, which are five or ſix in number, are dirty bluiſh white, marked at the large end with dark ſpots. The time of breeding is about the end of May or beginning of June. In the ſummer it moſtly frequents woods and the more retired places. In winter it approaches gardens and orchards, and has been generally ſtigmatiſed for making havock among the buds of trees. From ſome late obſervations, however, it would appear, that the object of theſe birds is not the bud, but "the *worm* in the bud;" and that this ſpecies, in conjunction with various other ſpecies of ſmall birds, are the frequent means of defending the embryo-fruits, and thence promoting their growth to maturity : for the warmth that ſwells the buds, not only hatches nidos (eggs) of unnumbered tribes of inſects, whoſe parent flies, by an unerring inſtinct, laid them there,—but brings forward a numerous race already in a caterpillar ſtate, that now iſſue from their concealments, and make their excurſion along the budding branches, and would probably deſtroy every hope of fruitage, but for thoſe uſeful inſtruments for its preſervation, whoſe young are principally fed by eating caterpillars.—The bullfinch, in its wild ſtate, has only a plain note ; but when tamed it becomes remarkably docile and may be taught any tune after a pipe, or to whiſtle any notes in the juſteſt manner : it ſeldom forgets what it has learned ; and will become ſo tame as to come at call, perch on its maſter's ſhoulders, and (at command) go through a difficult muſical leſſon. They may be alſo taught to ſpeak, and ſome thus inſtructed are annually brought to London from Germany.

5. The cœrulea, or blue groſsbeak, is the ſize of the bullfinch : The bill is ſtout, brown, and the baſe of it ſurrounded with black feathers which reach on each ſide as far as the eye ; the whole plumage beſides is of a deep blue, except the quills and tail, which are brown, with a mixture of green, and acroſs the wing coverts a band of red : the legs are duſky. It is an inhabitant of South America ; but is ſometimes found in Carolina, where it is a very ſolitary bird, and ſeen only in pairs, but diſappears in winter. It has only a ſingle note.

6. The violacea, or purple groſsbeak, is about the ſize of a ſparrow : The bill is black : the plumage, violet black ; except the irides, a ſtreak over the eye, the chin, and the vent, which are red : the legs are duſky grey. This ſpecies inhabits the Bahama Iſlands, Jamaica, and the warmer parts of America.

7. The cardinalis, or cardinal groſsbeak, is near eight inches in length. The bill is ſtout, and of a pale red colour : the irides are hazel : the head is greatly creſted, the feathers riſing up to a point when erect : round the bill, and on the throat, the colour is black ; the reſt of the bird of a fine red ; the quills and tail duller than the reſt, and browniſh within : the legs are the colour of the bill. The female differs from the male, being moſtly of a reddiſh brown. This ſpecies is met with in ſeveral parts of North America ; and has attained the name of nightingale from the fineneſs of its ſong, the note of which reſembles that of the nightingale. In ſpring, and moſt part of the ſummer, it ſits on the tops of the higheſt trees, ſinging early in the morning, and piercing the ear with its loud pipe. Theſe birds are frequently kept in cages, in which they ſing throughout the year, with only ſhort intervals of muteneſs. They are fond of *maize* and *buck-wheat* ; and will get together great hoards of theſe, often as much as a buſhel, which they artfully cover with leaves and ſmall twigs, leaving only a ſmall hole for entrance into the magazine. They are alſo fond of *bees*. They come the beginning of April into New York and the Jerſeys, and frequent the Magnolia ſwamps during the ſummer : in autumn they depart towards Carolina. They are pretty tame, frequently hopping along the road before the traveller ; but are not gregarious, ſcarce ever more than three or four being met with together. From their being familiar birds, attempts have been made to breed them in cages, but without ſucceſs.

8. The orix, or grenadier groſsbeak, is about the ſize of a houſe-ſparrow. The forehead, ſides of the head, and chin, are black ; the breaſt and belly the ſame ; the wings are brown, with pale edges ; and the reſt of the body of a beautiful red colour : the legs are pale. Theſe birds are inhabitants of Saint Helena ; they are alſo in plenty at the Cape of Good Hope, where they frequent watery places that abound with reeds, among which they are ſuppoſed to make their neſt. If (as is ſuppoſed) this be the ſame with Kolben's Finch, he ſays that the neſt is of a peculiar contrivance, made with ſmall twigs, interwoven very cloſely and tightly with cotton, and divided into two apartments with but one entrace (the upper for the male, the lower for the female), and is ſo tight as not to be penetrated by any weather. He adds, that the bird is ſcarlet only in ſummer, being in the winter wholly aſh-coloured. Theſe birds, ſeen among the green reeds, are ſaid to have a wonderful effect ; for, from the brightneſs of their colours, they appear like ſo many *ſcarlet lilies*.

9. The Philippina, or Philippine groſsbeak, is about the ſize of a ſparrow : the top of the head, the hind part of the neck and back, and the ſcapulars, are yellow, the middle of the feathers brown : the lower part of the back is brown, with whitiſh margins : the fore part of the neck and breaſt are yellow ; and from thence to the vent yellowiſh white ; the wing-coverts brown, edged with white : the quills are brown, with pale rufous or whitiſh edges ; and the tail the ſame : the legs are yellowiſh. Theſe birds inhabit the Philippine Iſlands ; and are noted for making a moſt curious neſt, in form of a long cylinder, ſwelling out into a globoſe form in the middle. This is compoſed of the fine fibres of leaves, &c. and faſtened by the upper part to the extreme branch of a tree. The entrance is from beneath ; and, after aſcending the cylinder as far as the globular cavity, the true neſt is placed on one ſide of it ; where this little architect

lays her eggs and hatches her brood in perfect ſecurity.

A variety of this ſpecies, the *Baglaſechat* (Buff. iii. 469), an inhabitant of Abyſſinia, makes a very curious neſt like the former, but a little different in ſhape; and is ſaid to have ſomewhat of a ſpiral form, not unlike that of a nautilus. It ſuſpends it, like the other, on the extreme twig of ſome tree, chiefly one that hangs over ſome ſtill water; and always turns the opening towards that quarter from whence leaſt rain may be expected.

10. The Abyſſinica, or Abyſſinian groſsbeak, is about the ſize of the hawfinch: the bill is black: the irides are red: the top and ſides of the head, throat, and breaſt are black: the upper parts of the body, belly, and thighs, pale yellow, inclining to brown where the two colours divide: the ſcapulars are blackiſh; the wing-coverts brown, bordered with grey; the quills and tail brown edged with yellow: the legs are of a reddiſh grey. This bird is found in Abyſſinia; and makes a curious neſt of a pyramidal ſhape, which is ſuſpended from the ends of branches like the others. The opening is on one ſide, facing the eaſt: the cavity is ſeparated in the middle by a partition; up which the bird riſes perpendicularly about half-way, when deſcending, the neſt is within the cavity on one ſide. By this means the brood is defended from ſnakes, ſquirrels, monkeys, and other miſchievous animals, beſides being ſecure from rain, which in that country ſometimes laſts for ſix months together.

11. The penſilis, or penſile groſsbeak, (the *Toddy-bird* of Fryer), is about the ſize of the houſe-ſparrow: the bill is black: the irides are yellow: the head, throat, and fore-part of the neck, the ſame: from the noſtrils ſprings a dull green ſtripe, which paſſes through the eye and beyond it, where it is broader: the hind part of the head and neck, the back, rump, and wing-coverts are of the ſame colour: the quills are black, edged with green; the belly is deep grey, and the vent of a rufous red: the tail and legs are black. This ſpecies is found at Madagaſcar; and fabricates the neſt of a curious conſtruction, compoſed of ſtraw and reeds interwoven in ſhape of a bag, the opening beneath. It is faſtened above to a twig of ſome tree; moſtly to thoſe growing on the borders of ſtreams. On one ſide of this, within, is the true neſt. The bird does not form a new neſt every year, but faſtens a new one to the end of the laſt; and often as far as five in number, one hanging from another. Theſe build in ſociety, like rooks; often five or ſix hundred being ſeen on one tree. They have three young at each hatch.

Kæmpfer † mentions a bird ſimilar to this, if not the ſame, which makes the neſt near Siam, on a tree with narrow leaves and ſpreading branches, the ſize of an apple-tree: the neſt in the ſhape of a purſe, with a long neck, made of dry graſs and other materials, and ſuſpended at the ends of the branches; the opening always to the north-weſt. He counted fifty on one tree only; and deſcribes the bird itſelf as being like a Canary-bird, of a dark yellow, and chirps like a ſparrow.

Fryer ‡ alſo talks of the ingenuity of the *Toddy-Bird*, making a neſt "like a ſteeple, with winding meanders," and tying it by a ſlender thread to the bough of a tree. Hundreds of theſe pendulous neſts may be ſeen on theſe trees."

12. The chloris or greenfinch, is a well-known bird: the general colour is a yellowiſh green, paleſt on the rump and breaſt, and inclining to white on the belly; the quills are edged with yellow, and the four outer tail-feathers are yellow from the middle to the baſe; the bill is pale-brown, and ſtout; and the legs of a fleſh-colour.—This ſpecies is pretty common in Britain, and flies in troops during the winter. It makes the neſt in ſome low buſh or hedge, compoſed of dry graſs, and lined with hair, wool, &c. laying five or ſix greeniſh eggs, marked at the larger end with red brown; and the male takes his turn in ſitting. This bird ſoon becomes tame; even old ones being familiar almoſt as ſoon as caught: it lives five or ſix years. Like the chaffinch, it is apt to grow blind if expoſed to the ſun. This ſpecies is alſo pretty common every where on the continent of Europe; but not very frequent in Ruſſia; and is not at all found in Siberia, though it has been found in Kamtſchatka. It is ſufficiently common both in Cumberland and Scotland: yet in the firſt, it is ſcarce ever obſerved in the winter ſeaſon; but the laſt week in March becomes plentiful, and breeds as in other parts of England.

13. The Bengalenſis, or Bengal groſsbeak, is a trifle bigger than a houſe-ſparrow: the bill is of a fleſh-colour; the irides are whitiſh; the top of the head is of a golden-yellow; the upper parts of the body are brown, with paler edges; the ſides of the head and under parts rufous white; acroſs the breaſt is a brown band, uniting to, and of the ſame colour with, the upper parts of the body; the legs are of a pale yellow; the claws grey. This ſpecies (thus deſcribed by Mr Latham) ſeems to be the ſame with the Indian groſsbeak deſcribed as follows in the *Aſiatic Reſearches*. "This little bird, called *bayà* in Hindì, *berbera* in Sanſcrit, *bàbúï* in the dialect of Bengal, *cíbù* in Perſian, and *tenawwit* in Arabic, from his remarkably pendant neſt, is rather larger than a ſparrow, with yellow brown plumage, a yellowiſh head and feet, a light-coloured breaſt, and a conic beak very thick in proportion to his body. This bird is exceedingly common in Hindoſtan: he is aſtoniſhingly ſenſible, faithful, and docile, never voluntarily deſerting the place where his young were hatched, but not averſe, like moſt other birds, to the ſociety of mankind, and eaſily taught to perch on the hand of his maſter. In a ſtate of nature he generally builds his neſt on the higheſt tree that he can find, eſpecially on the palmyra, or on the Indian fig-tree, and he prefers that which happens to overhang a well or a rivulet: he makes it of graſs, which he weaves like cloth and ſhapes like a large bottle, ſuſpending it firmly on the branches, but ſo as to rock with the wind, and placing it with its entrance downwards to ſecure it from birds of prey. His neſt uſually conſiſts of two or three chambers; and it is the popular belief that he lights them with fire-flies, which he catches alive at night, and confines with moiſt clay or with cow-dung: That ſuch flies are often found in his neſt, where pieces of cow-dung are alſo ſtuck, is indubitable; but as their light could be of little uſe to him, it ſeems probable that he only feeds on them. He may be taught with eaſe to fetch a piece of paper, or any

† *Japan*, p. 35.

‡ *Account of India and Perſia*, p. 76.

ſmall thing that his maſter points out to him: It is an atteſted fact, that if a ring be dropped into a deep well, and a ſignal given to him, he will fly down with amazing celerity, catch the ring before it touches the water, and bring it up to his maſter with apparent exultation; and it is confidently aſſerted, that if a houſe or any other place be ſhown to him once or twice, he will carry a note thither immediately on a proper ſignal being made. One inſtance of his docility I can myſelf mention with confidence, having often been an eye-witneſs of it. The young Hindoo women at Benares, and in other places, wear very thin plates of gold, called *ticas*, ſlightly fixed by way of ornament between their eyebrows; and when they paſs through the ſtreets, it is not uncommon for the youthful libertines, who amuſe themſelves with training bayàs, to give them a ſignal, which they underſtand, and ſend them to pluck the pieces of gold from the foreheads of their miſtreſſes, which they bring in triumph to the lovers. The bayà feeds naturally on graſshoppers and other inſects; but will ſubſiſt, when tame, on pulſe maccrated in water: his fleſh is warm and drying, of eaſy digeſtion, and recommended in medical books as a ſolvent of ſtone in the bladder or kidneys; but of that virtue there is no ſufficient proof. The female lays many beautiful eggs reſembling large pearls; the white of them, when they are boiled, is tranſparent, and the flavour of them is exquiſitely delicate. When many bayàs are aſſembled on a high tree, they make a lively din; but it is rather chirping than ſinging: Their want of muſical talents is however amply ſupplied by their wonderful ſagacity, in which they are not excelled by any feathered inhabitant of the foreſt."

14. The nigra, or black groſsbeak, is about the ſize of a Canary bird: the bill is black, ſtout, and deeply notched in the middle of the upper mandible: the plumage is black, except a little white on the fore-part of the wing and baſe of the two firſt quills: the legs are black. It inhabits Mexico.

15. The minuta, or minute groſsbeak, is about the ſize of a wren: the bill is ſtout, thick, ſhort, and brown: the upper parts of the plumage are grey brown, the under parts and rump ferruginous cheſnut; the fourth, fifth, and ſixth quills are white at the baſe: the legs are brown. It inhabits Surinam and Cayenne. —It is ſaid to keep paired to its mate the whole year; and is a lively and not very tame bird. It moſtly frequents lands which have lain for ſome time uncultivated; and lives both on fruits and ſeeds. It makes a roundiſh neſt, the hollow of which is two inches in diameter, compoſed of a reddiſh herb, and placed on the trees which it frequents. The female lays three or four eggs.

16. The ſocia, or ſociable groſsbeak, is about the ſize of a bullfinch: the general colour of the body above is a rufous brown, the under parts yellowiſh: the beak and muzzle are black; the legs brown; and the tail is ſhort. It inhabits the interior country at the Cape of Good Hope; where it was diſcovered by Mr Paterſon.—Theſe birds, according to our author, live together in large ſocieties: and their mode of nidification is extremely uncommon. They build in a ſpecies of *Mimoſa* which grows to an uncommon ſize; and which they ſeem to have ſelected for that purpoſe, as well on account of its ample head, and the great ſtrength of its branches, calculated to admit and to ſupport the extenſive buildings which they have to erect, as for the tallneſs and ſmoothneſs of its trunk, which their great enemies, the ſerpent-tribe, are unable to climb. The method in which the neſts themſelves are fabricated, is highly curious. In the one deſcribed by Mr Paterſon there could be no leſs a number (he ſays) than from 800 to 1000 reſiding under the ſame roof †. He calls it a roof, becauſe it perfectly reſembles that of a thatched houſe; and the ridge forms an angle ſo acute and ſo ſmooth, projecting over the entrance of the neſt below, that it is impoſſible for any reptile to approach them. The induſtry of theſe birds "ſeems almoſt equal (ſays our author) to that of the bee; throughout the day they appear to be buſily employed in carrying a fine ſpecies of graſs, which is the principal material they employ for the purpoſe of erecting this extraordinary work, as well as for additions and repairs. Though my ſhort ſtay in the country was not ſufficient to ſatisfy me by ocular proof, that they added to their neſt as they annually increaſed in numbers, ſtill from the many trees which I have ſeen borne down with the weight, and others which I have obſerved with their boughs completely covered over, it would appear that this is really the caſe; when the tree which is the ſupport of this aerial city is obliged to give way to the increaſe of weight, it is obvious that they are no longer protected, and are under the neceſſity of rebuilding in other trees. One of theſe deſerted neſts I had the curioſity to break down, ſo as to inform myſelf of the internal ſtructure of it, and found it equally ingenious with that of the external. There are many entrances, each of which forms a regular ſtreet, with neſts on both ſides, at about two inches diſtance from each other. The graſs with which they build is called the Boſhman's graſs; and I believe the ſeed of it to be their principal food; though, on examining their neſts, I found the wings and legs of different inſects. From every appearance, the neſt which I diſſected had been inhabited for many years; and ſome parts of it were much more complete than others: this therefore I conceive nearly to amount to a proof, that the animals added to it at different times, as they found neceſſary, from the increaſe of the family, or rather of the nation or community.

Journies into the country of the Hottentots, p. 133. &c.

17. The tridactyla, or three-toe'd groſhbeak (the guifso balito of *Buffon*), has only three toes, two before and one behind. The bill is toothed on the edges: the head, throat, and fore-part of the neck are of a beautiful red, which is prolonged in a narrow band quite to the vent; the upper part of the neck, back, and tail are black; the wing coverts brown; edged with white; quills brown, with greeniſh edges; and legs a dull red: the wings reach half way on the tail.—This ſpecies inhabits Abyſſinia; where it frequents woods, and is a ſolitary ſpecies. It feeds on kernels of ſeeds, which it breaks with eaſe with its bill. The name in its native place is *guifso batito dimmo-won jerck*. Buffon's figure is from Mr Bruce's drawings.

There are 76 other ſpecies of this genus; the whole number, beſides varieties, enumerated in the *Syſt. Nat.* (Gmelin), and in Mr Latham's *Index Ornith.* being 93.

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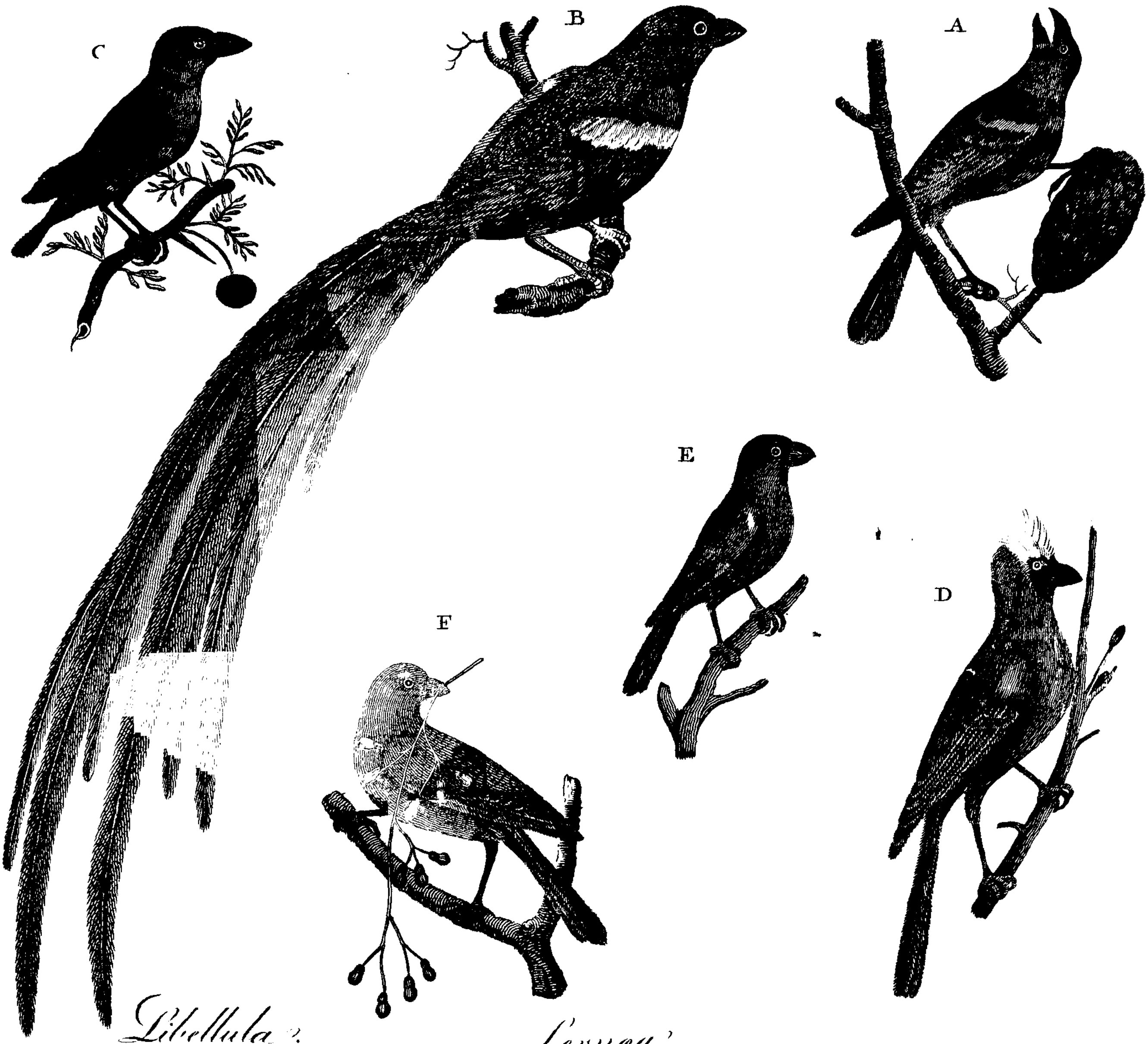
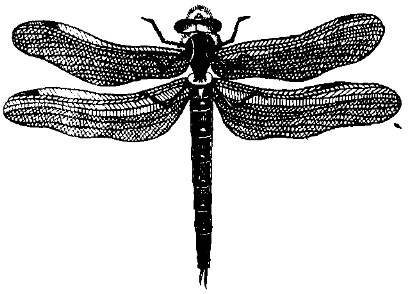
† See the Plate referred to at Mimosa.

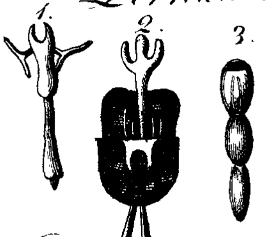
Loxia.



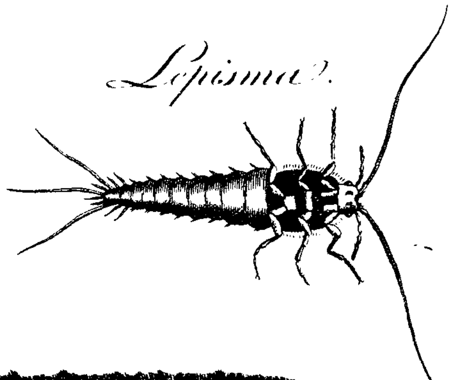
Libellula?



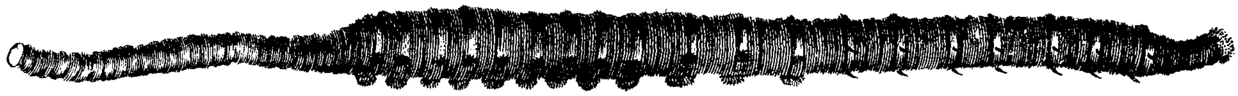
Lernæa?



Lepisma?



Lumbricus marinus.



Smither sculp.

On Plate CCLXXIV. are given ſpecimens of ſix, *viz.* A, the Cærulea; B, the Longicauda; C, the Socia; D, the Cardinalis; E, the Nigra; F, the Violacea.

LOYOLA (Ignatius). See IGNATIUS.

LOZENGE, in heraldry, a four-cornered figure, reſembling a pane of glaſs in old caſements. See HERALDRY, p.455. col.1. Though all heralds agree, that ſingle ladies are to place their arms on lozenges, yet they differ with reſpect to the cauſes that give riſe to it. Plutarch ſays, in the life of Theſeus, that in Megara, an ancient town of Greece, the tomb-ſtones, under which the bodies of the Amazons lay, were ſhaped after that form; which ſome conjecture to be the cauſe why ladies have their arms on lozenges. *S Petra Sancta* will have this ſhield to repreſent a *cuſhion*, whereupon women uſed to ſit and ſpin, or do other houſewifery. Sir J. Ferne thinks it is formed from the ſhield called *teſſera*, which the Romans finding unfit for war, did allow to women to place their enſigns upon, with one of its angles always uppermoſt.

LOZENGES, among Jewellers, are common to brilliant and roſe diamonds. In brilliants, they are formed by the meeting of the ſkill and ſtar facets on the bezil; in the latter, by the meeting of the facets in the horizontal ribs of the crown. See FACETS.

LOZENGE is alſo a form of medicine, made into ſmall pieces, to be held or chewed in the mouth till they are melted there; the ſame with what are otherwiſe called *trochiſci*, "troches."

LUBEC, a city and port-town of Germany, in the circle of Lower Saxony and duchy of Holſtein, in E. Long. 10. 35. N. Lat. 54. 20. It ſtands at the conflux of ſeveral rivers, the largeſt of which is the Trave, 12 miles from the Baltic, where it has a fine harbour, and 40 north-eaſt of Hamburg. By the Steckenitz, another of thoſe rivers, it has a communication with the Elbe, and conſequently with the German ocean. The city lies on the ſide of a hill, with the Trave, increaſed by the Steckenitz on the one ſide, and the Weckenitz on the other; and is ſtrongly fortified with baſtions, moats, walls, and ramparts; the laſt of which are planted with trees, and form an agreeable walk. Lubec being formerly the chief of the Hanſe towns, was very powerful in conſequence of the vaſt trade it carried on; but a great part of that trade is now transferred to Hamburg: however, it is ſtill ſaid to employ 150 of its own ſhips, and has a great ſhare of the Baltic trade. It is about two miles in length, and more than one in breadth. The houſes are all of ſtone, but old-faſhioned. Several of the ſtreets have on each ſide rows of lime-trees, with canals in the middle, like thoſe of Holland. The public ſtructures conſiſt of the ancient cathedral of the biſhopric of Lubec, and ſeveral other Lutheran churches; a nunnery for 22 ladies, with an abbeſs and prioreſs; a poor-houſe, an alms-houſe, and houſe of correction; an orphan-houſe; an hoſpital dedicated to the Holy-Ghoſt; a houſe in which poor travellers are entertained three days, and then ſent forward with a paſs; but ſuch as happen to be ſick, are provided with all neceſſaries till they recover or die; the city-armoury, a grammar-ſchool of ſeven claſſes, the Calviniſt church, and the Popiſh chapel. The deputies of the Hanſe-towns uſed to meet here formerly in the town-houſe, An alliance ſtill ſubſiſts between Lubec. Hamburg, and Bremen; and theſe cities, under the name of *Hanſe-towns*, negociate treaties with foreign powers. Here are divers manufactures, and the city's territory is about 60 miles in compaſs. In the diet of the empire Lubec is poſſeſſed of the third ſeat among the Rheniſh imperial cities; and among thoſe of the circle, has the firſt. In the matricula, its aſſeſſment is 480 florins, and to the chamber of Wetzlar it pays 557 rixdollars and 88 kruitzers. The city is a republic within itſelf, and both makes and executes laws in regard to civil and criminal matters, &c. A father and ſon or two brothers, cannot be in the regency at the ſame time. The famous league of the Hanſe-towns was begun here in 1164. This city had its charter of privileges from the emperor Frederic II. Formerly it carried on wars, both offenſive and defenſive, for ſeveral years, not only againſt the dukes of Mecklenburg, but againſt the kings of Sweden and Denmark; particularly in 1428, when it fitted out 250 ſhips of force againſt Eric X. king of Denmark. There are about 20 churches in Lubec, with lofty ſteeples or ſpires. The Trave brings ſhips of burden into the very heart of the city; but the largeſt unload at Travemunde, *i. e.* the mouth of the Trave, eight or ten miles diſtant. Formerly it is ſaid to have employed no leſs than 600 ſhips. In the famous cellar here, it is ſaid there is wine 200 years old. The church of St Mary's, a noble lofty pile, is ſupported by tall pillars, all of one ſtone each, and has a high ſpire, covered with gilt lead. The town's garriſon conſiſts of about 700 or 800 men. The revenue of its Lutheran biſhop, though he is a prince of the empire, is ſaid not to exceed 3000 pounds.

LUBEN, a city of Germany, in the marquiſate of Lower Luſatia. It is ſituated on the river Spree, and is the capital of a ſmall circle of the ſame name. It is the ſeat of the diets, and of the chief tribunals and offices; and has ſeveral churches, with a noble land-houſe and hoſpital. E. Long. 14. 25. N. Lat. 52. 0.

LUBIENIETSKI (Staniſlaus), a Poliſh gentleman, deſcended from a noble family, and born at Cracow in 1623, was educated by his father with great attention. He became a celebrated Socinian miniſter; and took great pains to obtain a toleration from the German princes for his Socinian brethern. His labours, however, were ineffectual; being himſelf perſecuted by the Lutheran miniſters, and baniſhed from place to place; until at length he was baniſhed out of the world, with his two daughters, by poiſon, his wife narrowly eſcaping, in 1675. We have of his writing *A hiſtory of the reformation in Poland; A treatiſe on comets;* with other works in Latin.

LUBIN (Eilhard), was profeſſor of poetry in the univerſity of Roſtock in 1595: and ten years after, was promoted to the profeſſorſhip of divinity. He wrote notes on Anacreon, Juvenal, Perſius, &c. and ſeveral other works; but that which made the moſt noiſe is a Treatiſe on the nature and origin of evil, intitled, *Phoſphorus de cauſa prima et natura mali*, printed at Roſtock in 1596; in which we have a curious hypotheſis to account for the origin of moral evil. He ſuppoſed two co-eternal principles; not *matter* and *va-*

cuum, as Epicurus did; but God, and *Nihilum* or *Nothing*. This being publiſhed againſt by Grawer, was defended by Lubin; but after all he is deemed better acquainted with polite literature than with divinity. He died in 1621.

LUBLIN, a handſome and conſiderable town of Poland, capital of the Palatinate of the ſame name, with a citadel, a biſhop's ſee, an univerſity, and a handſome Jewiſh ſynagogue. Here the judicial courts for all Poland are held. It had three fairs, frequented by merchants from all nations. It is ſeated on the river Byſtrzna. E. Long. 22. 31. N. Lat. 51. 26.

LUCA, (anc. geog.), a town of Etruria, on the river Auſer; a colony and a municipium. Now *Lucca*, capital of the republic of that name, near the river Sechia. E. Long. 11. 20. Lat. 43. 45.

LUCANIA, a country of Italy, and a part of Magna Græcia; bounded on the north by the river Silarus by which it was ſeparated from the Picentini, and by the river Bradanus by which it was parted from the Apuli Peucetii; on the ſouth by the Laus, which ſeparated it from the Bruttii; on the eaſt by the Sinus Tarentinus; and on the weſt by the Tuſcan ſea. *Lucani*, the people, deſcendants of the Samnites. *Lucanus* the epithet, (Horace). *Lucæ boves* denoted elephants; firſt ſeen in Pyrrhus's wars in Lucania, whence the appellation (Pliny).

LUCANUS (Marcus Annæus), a Latin poet, born at Corduba in Spain, about A. C. 39. He was the ſon of Annæus Mela, the youngeſt brother of Seneca; and was conveyed to Rome from the place of his nativity at the age of eight months: a circumſtance, as his more indulgent critics obſerve, which ſufficiently refutes the cenſure of thoſe who conſider his language as provincial. At Rome he was educated under the Stoic Cornutus, ſo warmly celebrated by his diſciple Perſius the ſatiriſt, who was the intimate friend of our poet. In the cloſe of his education, Lucan is ſaid to have paſſed ſome time at Athens. On his return to Rome he roſe to the office of quæſtor, before he had attained the legal age. He was afterward inrolled among the augurs; and married a lady of noble birth, and of a moſt amiable character. Lucan had for ſome time been admitted to familiarity with Nero, when the emperor choſe to contend for poetical honours by the public recital of a poem he had compoſed on Niobe; and ſome verſes of this imperial production are ſuppoſed to be preſerved in the firſt ſatire of Perſius. Lucan had the hardineſs to repeat a poem on Orpheus, in competition with that of Nero; and, what is more remarkable, the judges of the conteſt were juſt and bold enough to decide againſt the emperor. From hence Nero became the perſecutor of his ſucceſsful rival, and forbade him to produce any poetry in public. The well-known conſpiracy of Piſo againſt the tyrant ſoon followed; and Tacitus, with his uſual ſarcaſtic ſeverity, concludes that Lucan engaged in the enterprize from the poetical injuries he had received: "a remark (ſays Mr Hayley*, who has endeavoured to refute the imputation) which does little credit to the candour of the Hiſtorian; but might have found a much nobler, and, I will add, a more probable motive for his conduct, in the generous ardor of his character, and his paſſionate adoration of freedom. In the ſequel of his narration, Tacitus alleges a charge againſt our poet, which, if it were true, muſt lead us to deteſt him as the moſt abject of mankind. The hiſtorian aſſerts, that Lucan, when accuſed of the conſpiracy, for ſome time denied the charge; but corrupted at laſt by a promiſe of impunity, and deſirous to atone for the tardineſs of his confeſſion, accuſed his mother Atilla as his accomplice. This circumſtance is ſo improbable in itſelf, and ſo little conſonant to the general character of Lucan, that ſome writers have treated it with contempt, as a calumny invented by Nero, to vilify the object of his envious abhorence. But the name of Tacitus has given ſuch an air of authority to the ſtory that it may ſeem to deſerve a more ſerious diſcuſſion, particularly as there are two ſubſequent events related by the ſame hiſtorian, which have a tendency to invalidate the accuſation ſo injurious to our poet. The events I mean are, the fate of Annæus, and the eſcape of Atilla, the two parents of Lucan. The former died in conſequence of the accuſation brought againſt him, after the death of his ſon, by Fabius Romanus, who had been an intimate with Lucan, and forged ſome letters in his name, with the deſign of proving his father concerned in the conſpiracy. Theſe letters were produced to Nero, who ſent them to Annæus, from an eager deſire, ſays Tacitus, to get poſſeſſion of his wealth. From this fact two inferences may be drawn, according to the different lights in which it may be conſidered:—If the accuſation againſt Annæus was juſt, it is clear that Lucan had not betrayed his father, and he appears the leſs likely to have endangered by his confeſſion the life of a parent, to whom he owed a ſtill tenderer regard—If Annæus was not involved in the conſpiracy, and merely put to death by Nero for the ſake of his treaſure, we may the more readily believe, that the tyrant who murdered the father for avarice, might calumniate the ſon from envy. But the eſcape of Atilla affords us the ſtrongeſt reaſon to conclude that Lucan was perfectly innocent of the abject and unnatural treachery of which Tacitus has ſuppoſed him guilty. Had the poet really named his mother as an accomplice, would the vindictive and ſanguinary Nero have ſpared the life of a woman whoſe family he deteſted, particularly when other females were put to death for their ſhare in the conſpiracy? That Atilla was not in that number, the hiſtorian himſelf informs in the following remarkable ſentence, "Atilla mater Annæi Lucani, ſine abſolutione, ſine ſupplicio, diſſimulata;" thus tranſlated by Gordon: "the information againſt Atilla, the mother of Lucan, was diſſembled; and, without being cleared, ſhe eſcaped unpuniſhed."

The preceding remarks will, our author hopes, vindicate to every candid mind the honour of Lucan, whoſe firmneſs and intrepidity of character are indeed very forcibly diſplayed in that picture of his death which Tacitus himſelf has given us. He was condemned to have his veins cut, as his uncle Seneca had before him. Lucan, "while his blood iſſued in ſtreams, perceiving his feet and hands to grow cold and ſtiffen, and life to retire by little and little to the extremities, while his heart ſtill beating with vital warmth, and his faculties nowiſe impaired, recollected ſome lines of his own, which deſcribed a wounded ſoldier expiring in a manner that reſembled this. The lines themſelves he rehearſed; and they were the laſt words he ever uttered." The critics differ concerning the

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* In the *Notes* to his *Second Epiſtle on Epic Poetry*.

verſes of the Pharſalia which the author quoted in ſo memorable a manner. The two paſſages he is ſuppoſed to have repeated are the following; of which Lipſius contends for the latter.

> Sanguis erant lacrymæ : quæcunque foramina nova
> Humor, ab his largus manat cruor; ora redundant,
> Et patulæ nares : ſudor rubet : omnia plenis
> Membra fluunt venis : totum eſt pro vulnere corpus.
> Lib. ix. 814.
>
> Now the warm blood at once, from every part,
> Ran purple poiſon down, and drain'd the fainting heart.
> Blood falls for tears; and o'er his mournful face
> The ruddy drops their tainted paſſage trace.
> Where'er the liquid juices find a way,
> There ſtreams of blood, there crimſon rivers ſtray.
> His mouth and guſhing noſtrils pour a flood,
> And e'en the pores ouze out the trickling blood;
> In the red deluge all the parts lie drown'd,
> And the whole body ſeems one bleeding wound.
> Rowe.
>
> Scinditur avulſus; nec ſicut vulnere ſanguis
> Emicuit lentus; ruptis cadit undique venis,
> Diſcurſuſque animæ, diverſa in membra meantis,
> Interceptus aquis. Lib. iii. v. 638.
>
> No ſingle wound the gaping rupture ſeems,
> Where trickling crimſon wells in ſlender ſtreams;
> But, from an op'ning horrible and wide,
> A thouſand veſſels pour the burſting tide:
> At once the winding channel's courſe was broke,
> Where wand'ring life her mazy journey took;
> At once the currents all forgot their way,
> And loſt their purple in the azure ſea. Rowe.

Such was the death of Lucan before he had completed his 27th year.—His wife, Polla Argentaria, is ſaid to have tranſcribed and corrected the three firſt books of the Pharſalia after his death. It is much to be regretted (Mr Hayley obſerves) that we poſſeſs not the poem which he wrote on the merits of this amiable and accompliſhed woman; but her name is immortalized by two ſurviving poets of that age. The veneration which ſhe paid to the memory of her huſband is recorded by Martial; and more poetically deſcribed in that pleaſing and elegant little production of Statius, *Genethliacon Lucani*, a poem ſaid to have been written at the requeſt of Argentaria. The author, after invoking the poetical deities to attend the ceremony, touches with great delicacy and ſpirit on the compoſitions of Lucan's childhood, which are loſt, and the Pharſalia, the production of his early youth: he then pays a ſhort compliment to the beauty and talents of Argentaria; laments the cruel fate which deprived her ſo immaturely of domeſtic happineſs; and concludes with an addreſs to the ſhade of Lucan, which, with Mr Hayley's tranſlation, we ſhall ſubjoin in a Note, as it ſeems to furniſh a ſtrong preſumption of Lucan's innocence in regard to one of the accuſations mentioned above (A). "Had he been really guilty of baſely endangering the life of his mother (ſays Mr Hayley), it is not probable that his wife would have honoured his memory with ſuch enthuſiaſtic veneration; or that Statius, in verſes deſigned to do him honour, would have alluded to *the mother* of Nero. If his character as a man has been injured by the hiſtorian (continues Mr Hayley), his poetical reputation has been treated not leſs injuriouſly by the critics. Quintilian, by a frivolous diſtinction, diſputes his title to be claſſed among the poets; and Scaliger ſays, with a brutality of language diſgraceful only to himſelf, that he ſeems rather to *bark* than to *ſing*. But theſe inſults may appear amply compenſated, when we remember, that in the moſt poliſhed nations of modern Europe the moſt elevated and poetic ſpirits have been his warmeſt admirers; that in France he was idolized by Corneille, and in England tranſlated by Rowe.—The ſevereſt cenſures on Lucan have proceeded from thoſe who

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(A) At tu, ſeu rapidum poli per axem
Famæ curribus arduis levatus,
Qua ſurgunt animæ potentiores,
Terras deſpices, et ſepulchra rides:
Seu pacis meritum nemus recluſæ
Felix Elyſiis tenes in oris,
Quo Pharſalica turba congregatur;
Et te nobile carmen inſonantem
Pompeii comitantur et Catones:
Tu magna ſacer et ſuperbus umbra
Neſcis Tartaron, et procul nocentum
Audis verbera, pallidumque viſa
Matris lampade reſpicis Neronem.
Adſis lucidus; et vocante Polla
Unam, quæſo, diem deos ſilentum
Exores; ſolet hoc patere limen
Ad nuptas redeuntibus maritis.
Hæc te non thiaſis procax doloſis
Falſi numinis induit figuras;
Ipſum ſed colet, et frequentat ipſum
Imis altius inſitum medullis;
Ac ſolatia vana ſubminiſtrat
Vultus, qui ſimili notatus auro
Stratis prænitet, excubatque ſomno
Securæ. Procul hinc abite mortes;
Hæc vitæ genitalis eſt origo;
Cedat luctus atrox, geniſque manent
Jam dulces lacrymæ, dolorque feſtus
Quicquid fleverat ante nunc adoret.

But you, O! whether to the ſkies
On Fame's triumphant car you riſe,
(Where mightier ſouls new life aſſume)
And mock the confines of the tomb;
Or whether in Elyſium bleſt
You grace the groves of ſacred reſt,
Where the Pharſalian heroes dwell;
And, as you ſtrike your epic ſhell,
The Pompeys and the Catos throng
To catch the animating ſong;
Of Tartarus the dread controul
Binds not your high and hallow'd ſoul;
Diſtant you hear that wailing coaſt,
And ſee the guilty Nero's ghoſt
Grow pale with anguiſh and affright,
His mother flaſhing on his ſight.
Be preſent to your Polla's vows,
while to your honour'd name ſhe bows!
One day let your intreaties gain
From thoſe who rule the ſhadowy train!
Their gates have op'd to bleſs a wife,
And given a huſband back to life.
In you the tender fair invites
No fancied god with frantic rites:
you are the object of her prayers,
You in her inmoſt heart ſhe bears:
And, ſtampt on mimic gold, your head
Adorns the faithful mourner's bed,
And ſooths her eyes before they cloſe,
The guardian of her chaſte repoſe.
Away with all funereal ſtate!
From hence his nobler life we date:
Let mourning change the pang ſevere
To fond devotion's greatful tear!
And feſtal grief, its anguiſh o'er,
What it lamented, now adore!

have unfairly compared his language to that of Virgil: but how unjuſt and abſurd is ſuch a compariſon! it is comparing an uneven block of prophyry, taken rough from the quarry, to the moſt beautiful ſuperficies of poliſhed marble. How differently ſhould we think of Virgil as a poet, if we poſſeſſed only the verſes which he wrote at that period of life when Lucan compoſed his Pharſalia! In the diſpoſition of his ſubject, in the propriety and elegance of diction, he is undoubtedly far inferior to Virgil: but if we attend to the bold originality of his deſign, and to the vigour of his ſentiments; if we conſider the Pharſalia as the rapid and uncorrected ſketch of a young poet, executed in an age when the ſpirit of his countrymen was broken, and their taſte in literature corrupted; it may juſtly be eſteemed as one of the moſt noble and moſt wonderful productions of the human mind."—Lucan wrote ſeveral poems; but we have none remaining beſide his *Pharſalia*, of which an excellent Engliſh verſion has been given by Mr Nicholas Rowe.

LUCANUS, the STAG-BEETLE, in zoology; a genus of inſects of the order coleoptera. The antennæ end in a club or knob, which is compreſſed or flattened on one ſide, and divided into ſhort laminæ reſembling the teeth of a comb; the jaws are porrected or advanced before the head, and are dentated. There are 20 ſpecies. Plate CCLXXV The largeſt, as well as the moſt ſingular, is the cervus; which is eaſy to be known by two large moveable maxillae, reſembling in form the horns of a ſtag, which project from its head, and have in a ſpecial manner acquired it the appellation of Stag-Beetle. Thoſe maxillæ, broad and flat, equal to one third of the inſect's length, have in the middle, towards their inner part, a ſmall branch, and at their extremity are forked. Beſides this, they have ſeveral ſmall teeth throughout their whole length. The head that bears theſe maxillæ is very irregular, very broad and ſhort. The thorax is ſomething narrower than the head and body and margined round. The elytra are very plain, without either ſtreaks or lines. The whole animal is of a deep brown colour. It is commonly found upon the oak, but is ſcarce in the neighbourhood of London, and though the largeſt of coleopterous inſects to be met with in Europe, it is much ſmaller than thoſe of the ſame ſpecies that are found in woody countries. This creature is ſtrong and vigorous, and its horns, with which it pinches ſeverely, are carefully to be avoided.—The jaws are ſometimes as red as coral, which gives this inſect a very beautiful appearance; the female is diſtinguiſhed by the ſhortneſs of the jaws, which are not half ſo long as thoſe of the male.—Theſe inſect feed on the liquor that oozes from oaks, which they ſuck with their trunk or tongue. The females depoſit their eggs in the trunks of decayed trees, ſuch as the oak and the aſh. The larvæ or grubs lodge under the bark and in the hollow of old trees, which they eat into and reduce into fine powder, and there transform themſelves into chryſalids. They are common in Kent and Suſſex, and are ſometimes met with in other parts of England. The porrected jaws are particularly uſeful to theſe animals, in ſtripping off the bark from trees, and affixing themſelves thereby to the tree, while they ſuck with their trunk the juice that oozes from it.

LUCAR DE BARAMEDA (St), a handſome and conſiderable town of Spain, with a very good harbour, well defended, in Andaluſia. It was once the greateſt port in Spain, before the galleons unloaded their treaſure at Cadiz. It is ſeated at the mouth of the river Quadalquiver. W. Long. 6. 5. N. Lat. 36. 40.

LUCAR *de Guadiana* (St), a ſtrong town of Spain, in Andaluſia, on the confines of Algarve; ſeated on the river Guadiana, with a little harbour. W. Long. 5. 59. N. Lat. 37 32.

LUCAR *la major* (St), a ſmall town of Spain, in Andaluſia, with the title of a duchy. It is ſeated on the river Gaudiana, in W. Long. 6. 32. N. Lat 37. 21.

LUCARIA, a feaſt celebrated at Rome on the 18th of July, in memory of the flight of the Romans into a great wood, where they found an aſylum, and ſaved themſelves from deſtruction. This wood, in which they found protection, was ſituated between Tyber and the *Via Salaria* The enemies from whom the Romans fled were the Gauls.—On this feſtival, Plutarch tells us, it was cuſtomary to pay the actors, and ſuch as contributed to the public amuſement, with the money ariſing from the ſelling of wood. This money was called *lucar*. It is obvious, from what has been obſerved, that *lucar* and *lucaria* are derived from *lucus*, a grove.

LUCAS (Jacobs), an eminent artiſt, more generally known by the name of *Lucas van LEYDEN*, or *Hugenſe*, was born at Leyden in 1494. He received his firſt inſtructions in the art of painting from his father Hugues Jacobs; but completed his ſtudies in the ſchool of Cornelius Engelbrecht. He gained much money by his profeſſion; and being of a generous turn of mind, he ſpent it freely, dreſſed well, and lived in a ſuperior ſtyle. It is ſaid, that, a few years before his death, he made a tour into Zealand and Brabant; and during his journey, a painter of Fluſhing, envious of his great abilities, gave him poiſon at an entertainment; which, though very ſlow, was too fatal in its effect, and put an end to his life, after ſix years languiſhing under its cruel influence. Others, denying the ſtory of the poiſon, attribute his death to his inceſſant induſtry. The ſuperiority of this artiſt's genius manifeſted itſelf in his infancy: for his works, even from the age of nine, were ſo excellent, as to excite the admiration of all cotemporary artiſts; and when he was about 15, he painted a St Hubert, which gained him great applauſe. His tone of colouring (Mr Pilkington obſerves) is good, his attitudes (making a reaſonable allowance for the ſtiff German taſte) are well choſen, his figures have a conſiderable expreſſion in their faces, and his pictures are very highly finiſhed. He endeavoured to proportion the ſtrength of his colouring to the different degrees of diſtance in which his objects were placed: for in that early time, the true principles of perſpective were but little known, and the practice of it was much leſs obſerved. In the town-hall at Leyden, the moſt capital picture of Lucas, the ſubject of which is the Laſt Judgement, is preſerved with great care; the magiſtrates have refuſed very large ſums which have been offered for it.

This artiſt painted not only in oil, but alſo in diſtemper and upon glaſs. Nor was he leſs eminent for his engraving than for his painting. He carried on a familiar and friendly correſpondence with Albert Durer,

Durer, who was his cotemporary; and, it is ſaid, that as regularly as Albert Durer publiſhed one print, Lucas publiſhed another, without the leaſt jealouſy on either ſide, or wiſh to depreciate each other's merit. And when Albert came into Holland upon his travels, he was received by Lucas in a moſt cordial and affectionate manner. His ſtyle of engraving, however, according to Mr Strutt, differed conſiderably from that of Albert Durer, "and ſeems evidently to have been founded upon the works of Iſrael van Mechlen. His prints are very neat and clear, but without any powerful effect. The ſtrokes are as fine and delicate upon the objects in the front, as upon thoſe in the diſtances; and this want of variety, joined with the feebleneſs of the maſſes of ſhadow, give his engravings with all their neatneſs, an unfiniſhed appearance, much unlike the firm ſubſtantial effect which we find in the works of Albert Durer. He was attentive to the minutiæ of his art. Every thing is carefully made out in his prints, and no part of them is neglected. He gave great character and expreſſion to the heads of his figures; but, on examination of his works, we find the ſame heads too often repeated. The hands and feet are rather mannered than correct; and when he attempted to draw the naked figure, he ſucceeded but very indifferently. He affected to make the folds of his draperies long and flowing; but his female figures are frequently ſo exceſſively loaded with girdles, bandages, and other ornamental trappings, that much of the elegance of the deſign is loſt. He engraved on wood, as well as on copper; but his works on the former are by no means numerous. They are, however, very ſpirited; though not equal upon the whole, to thoſe of his friend Albert. The prints of this maſter are pretty numerous, but very ſeldom met with complete; eſpecially fine impreſſions of them. For though they are, generally ſpeaking, executed with the graver only, yet, from the delicacy of the execution, they ſoon ſuffered in the printing. Of his engravings the few following may be mentioned as among the principal. 1. *Mahomet ſleeping, with a prieſt murdered by his ſide, and another figure ſtealing his ſword,* a middle ſized upright plate, dated 1508, ſaid to be one of his moſt early productions. 2. An *ecce homo,* a large plate, lengthwiſe, dated 1510. 3. *The Crucifixion on Mount Calvary,* the ſame. 4. *The Wiſe Mens Offering,* the ſame, dated 1513. 5. *Return of the Prodigal Son,* a middling-ſized plate, lengthwiſe, dated 1518. 6. A large print lengthwiſe called the *Dance of Magdalen,* dated 1519. His own *Portrait,* a ſmall upright plate, dated 1525. 8. *David playing before Saul,* a middling-ſized upright plate, dated This is a very fine print; the expreſſion of Saul's countenance, in particular, is admirable. 9. A print known by the name of *Uleſpiegle,* which is the ſcarceſt of all the works of this maſter. It is in the collection of the king of France; and ſaid by Marolles, and other maſters, to be Unique. But Baſan informs us, that M. Mariette had alſo an impreſſion of this plate; and it has been ſince found in one or two other collections. It repreſents a travelling bag-piper with his family; himſelf playing as he goes along, and carrying two children in a baſket at his back; his wife trudging by his ſide, ſupporting with one hand an infant on her ſhoulder, and with the other leading an aſs loaded with two baſkets, having two children in each; and another child going before, with a little dog, completes the ſingular groupe. This rare print is dated 1520, and is known to have been ſold for 16 louis-d'ors.—It is nearly 7½ inches high by 4¾ broad; and has been twice copied. One of the copies is the reverſe way: but the other is the ſame way with the original; and though not ſo well executed, might without a compariſon be miſtaken for it.

Lucas (Richard), D. D. a learned Engliſh divine, was born in 1648, and ſtudied at Oxford: after which he entered into holy orders, and was for ſome time maſter of the free ſchool at Abergavenny. Being eſteemed an excellent preacher, he became vicar of St Stephen's, Coleman ſtreet, in London, and lecturer of St Olave's in Southwark. He was doctor of divinity; and in 1696 was inſtalled prebendary of Weſtminſter. His ſight began to fail him in his youth; and he totally loſt it in his middle age. He was greatly eſteemed for his piety and learning; and publiſhed ſeveral works, particularly, 1. Practical Chriſtianity. 2. An Inquiry after happineſs. 3. Several ſermons. 4. A Latin tranſlation of the whole duty of man. He died in 1715.

LUCCA, a ſmall republic of Italy on the coaſt of the Mediterranean, between the territory of Genoa on the weſt, Modena on the north, and Tuſcany on the eaſt. According to Keyſler, it is only about 30 miles in circumference, but is exceeding fertile and populous. It contains, beſides the city of Lucca, 150 villages. The number of inhabitants are computed at 120,000. The government is lodged in a gofalonier, whoſe power is much the ſame with that of the doges of Venice and Genoa. He is aſſiſted by nine councellors: but the power of all the ten continues only for two months; during which time they live in the ſtate-palace, and at the public expence. They are choſen out of the great council, which conſiſts of 240 nobles; but even this council is changed by a new election every two years. The revenues of the republic are about 400,000 ſcudi or crowns; out of which they maintain 500 men by way of regular force, and 70 Swiſs as a guard to their acting magiſtrates. The city of Lucca is ſituated in a plain, terminating in moſt delightful eminencies, adorned with villas, ſummer-houſes, corn-fields, and plantations of every kind; ſo that nothing either for uſe or pleaſure is here wanting. The city, which is about 3 Italian miles in circumference, has regular well-lined fortifications; and its ſtreets, though irregular, are wide, well-paved, and full of handſome houſes. The number of its inhabitants is computed to be above 40,000; and they carry on large manufactures, eſpecially of ſilk-ſtuffs. Lucca has a biſhop, who enjoys ſeveral extraordinary privileges; and its cathedral is Gothic. The city ſtands in E. Long. 11. 27. N. Lat. 43 52.

LUCENTI, Lucentia, or *Lucentum,* a town of the Hither Spain, now Alicant, a ſea-port of Valencia. W. Long. 32′, N. Lat. 38° 37′.

LUCERES, in Roman antiquity, the third in order of the three tribes into which Romulus divided the people, including all foreigners; ſo called from the *lucus* or grove, where Romulus opened an aſylum.

LUCERIA (anc. geog.), a town of Apulia in Italy; which in Strabo's time ſtill exhibited marks of Diomed's

Diomed's ſovereignty in thoſe parts. Ptolemy has *Nuceria*; whether from miſtake, or the cuſtom of his time uncertain. Now *Nocera de Pagani*, in the kingdom of Naples. E. Long. 15. 0. N. Lat. 40. 40.

LUCERIUS, in mythology, a name given to Jupiter, as *Luceria* was given to Juno, as the deities which gave light to the world.

LUCERNE, one of the 13 cantons of Swiſſerland. It holds the third place among the 13; and is the head of the Catholic cantons. Though leſs than Zuric, and conſequently much leſs than Berne; it is however, far more extenſive than any of the reſt, being 15 or 16 leagues long, and eight broad. The population is eſtimated at 100,000. Even the mountainous part is not barren, but abundant in wood and paſture, furniſhing cattle, hides, cheeſe, and butter, for exportation. All the north part is fertile in grain, fruit, and hay; ſupplying ſufficient for the conſumption of the inhabitants: but as the mountaineers of the little cantons come to their market for corn, the people of Lucerne purchaſe this commodity from other parts of Swiſſerland, but eſpecially from Alſace and Suabia. Their manufactures are very inconſiderable; conſiſting only in a little ſilk and cotton thread.—The government is oligarchical. The councils are choſen from among 500 citizens only. The great council of 64 members is the nominal ſovereign; but in fact the power reſides in the ſenate, or little council of 36, having for their chiefs the two Avoyers.—The whole canton profeſſes the Roman Catholic religion. The pope's nuncio, with the title of legate *a latere*, uſually reſides at Lucerne.—They threw off the Auſtrian yoke in 1352, and by entering into a perpetual alliance with the three ancient cantons, they gave ſuch weight to the confederacy, as to enable it in 1386 to reſiſt all the efforts of the enemy at the bloody battle of Sempach.

The *town of Lucerne* is ſituated at the extremity of a moſt beautiful lake of the ſame name, where the river Reuſs iſſues from it. The buildings are ancient, and the ſtreets narrow; nor is Lucerne populous in proportion to its extent, the inhabitants being only between 3 and 4000. Since this is the great paſſage to Italy by Mount St Gothard, and the merchandiſe which paſſes the Alps on mules, and is to be tranſported by the rivers Reuſs, Aar, and Rhine, is all depoſited here, it might have a flouriſhing trade if arts and manufactures were attended to. The Reuſs ſeparates the town into two unequal parts, which are connected by three bridges; one wide for carriages; and two narrow covered ones for foot paſſengers: beſides theſe, there is a fourth over an arm of the lake, to paſs to the cathedral. Three of theſe bridges have old bad paintings of the Dance of Death, and the Hiſtory of the Bible, and of Swiſſerland. They make a commodious dry walk for the inhabitants.—Of religious edifices, the principal are the cathedral, or collegiate church of St Leger; the convent of of Cordeliers; the college of Jeſuits; the convent of Capuchins; and the two convents of nuns. Of the ſecular buildings, the hotel de Ville is the principal. The arſenal is well furniſhed. The water tower is remarkable only for its poſition and antiquity: is is ſaid to have been a pharos or lighthouſe.—What greatly attracts moſt the notice of ſtrangers is, a plan in relief of part of the cantons of Lucerne, Zug, and Berne, and the whole of Schweitz, Uri, and Underwald, executed by General Pfiffer on a large ſcale. He has completed about 60 ſquare leagues; the plan is 12 feet long, and nine and an half broad: every mountain is accurately meaſured; and every object diſtinctly placed.

The *lake of Lucerne* exhibits greater variety and more pictureſque ſcenery than any other of the Swiſs lakes. It is ſeven leagues long in a right line, and three wide about Kuſſnacht; but the ſhape is very irregular. The whole ſouth ſide is bordered by high mountains; but the north exhibits hills of no great height. The narrow gulph that extends towards the weſt, is bordered on the weſt and north-weſt by mount Pilat, which is a ſingle mountain riſing boldly more than 6000 feet above the lake; and on the ſouth by mount Burgenberg. Stanz-Stadt, belonging to the canton of Underwald, is on this ſide; and hereabouts the lake is deepeſt. Kuſſnacht is on the point of the other gulph, which extends towards the eaſt, and is wider than the former. All the country to the weſt of theſe gulphs, and part of it to the north of the latter, belongs to the canton of Lucerne; but that which is to the ſouth and north-eaſt is dependant on the canton of Zug. All the mountains on the left ſhore of the lake belong to the canton of Underwald; thoſe on the right, partly to the canton of Uri, partly to that of Schweitz, partly to the little republic of Gerſaw, but principally to the canton of Lucerne.

LUCERNE, in botany. See MEDICAGO.—For the culture of this plant, ſee AGRICULTURE, nº 183.

LUCIA (St), one of the Caribbee Iſlands in the Weſt-Indies, about 22 miles long, and 11 broad, the middle of it lying in N. Lat. 19. 14. W. Long. 72. 0. It was firſt ſettled by the French in 1650; but was reduced by the Engliſh in 1664; who evacuated it in 1666. The French immediately re-ſettled the iſland, but were again driven away by the Caribbs. As ſoon as the ſavages were gone, the former inhabitants returned, but only for a ſhort time; for being afraid of falling a prey to the firſt privateer that ſhould viſit their coaſts, they removed either to other French ſettlements that were ſtronger, or where they might expect to be better defended. There was then no regular culture or colony at St Lucia; it was only frequented by the inhabitants of Martinico, who came thither to cut wood, and to build canoes, and who had conſiderable docks on the iſland. In 1718 it was again ſettled by the French; but four years after, it was given by the court of London to the duke of Montague, who was ſent to take poſſeſſion of it. This occaſioned ſome diſturbance between the two courts; which was ſettled, however, by an agreement made in 1731, that, till the reſpective claims ſhould be finally adjuſted, the iſland ſhould be evacuated by both nations, but that both ſhould wood and water there. This precarious agreement furniſhed an opportunity for private intereſt to exert itſelf. The Engliſh no longer moleſted the French in their habitations; but employed them as their aſſiſtants in carrying on with richer colonies a ſmuggling trade, which the ſubjects of both governments thought equally advantageous to them. This trade has been more or leſs conſiderable till the treaty of 1763, when the pro-

property of St Lucia was ſecured to the crown of France. After that time the colony flouriſhed conſiderably. In the beginning of the year 1772, the number of white people amounted to 2018 ſouls, men, women, and children; that of the blacks to 663 freemen, and 12,795 ſlaves. The cattle conſiſted of 928 mules or horſes, 2070 head of horned cattle, and 3184 ſheep or goats. There were 38 ſugar plantations, which occupied 978 pieces of land; 5,395,889 coffee-trees; 1,321,600 cocoa plants; and 367 plots of cotton. There were 706 dwelling places. The annual revenue at that time was about 175,000l. which, according to the Abbé Raynal, muſt have increaſed one eighth yearly for ſome time. It was taken by the Britiſh fleet under admirals Byron and Barrington, in the year 1778; but was reſtored to France at the peace of 1783.

The ſoil of St Lucia is tolerably good, even at the ſea ſide; and is much better the farther one advances into the country. The whole of it is capable of cultivation, except ſome high and craggy mountains which bear evident marks of old volcanoes. In one deep valley there are ſtill eight or ten ponds, the water of which boils up in a dreadful manner, and retains ſome of its heat at the diſtance of 6000 toiſes from its reſervoirs. The air in the inland parts, like that of all other uninhabited countries, is foul and unwholeſome; but grows leſs noxious as the woods are cleared and the ground laid open. On ſome parts of the ſea-coaſt, the air is ſtill more unhealthy, on account of ſome ſmall rivers which ſpring from the foot of the mountains, and have not ſufficient ſlope to waſh down the ſands with which the influx of the ocean ſtops up their mouths, by which means they ſpread themſelves into unwholeſome marſhes on the neighbouring grounds.

Lucia (St), a high and mountainous iſland of Africa, and one of thoſe of Cape Verde, is about nine leagues long, and lies in the latitude of 16° 18′ N. according to the Engliſh geographers; but according to all others, it is a degree farther to the northward. On the eaſt-ſouth-eaſt ſide is a harbour, with a bottom and ſhore of white ſand; but its beſt road is oppoſite to St Vincent's to the ſouth-weſt, where there are at leaſt 20 fathoms of water. On the weſt ſide there is no water: it abounds with goats, ſea and land fowl, tortoiſes, &c. but whether it hath any inhabitants is not certainly known.

LUCIAN, a celebrated Greek author in the firſt century, was born at Samoſata, of obſcure parents, in the reign of the emperor Trajan. He ſtudied law, and practiſed ſome time as an advocate; but growing weary of the wrangling oratory of the bar, he commenced rhetorician. He lived to the time of Marcus Aurelius, who made him regiſter of Alexandria in Egypt; and, according to Suidas, he was at laſt worried by dogs. Lucian was one of the fineſt wits in all antiquity. His dialogues, and other works, are written in Greek. In theſe he has joined the uſeful to the agreeable, inſtruction to ſatire, and erudition to elegance; and we every where meet with that fine and delicate raillery which characteriſes the Attic taſte.—Thoſe who cenſure him as an impious ſcoffer at religion, have reaſon on their ſide, if religion conſiſted in the theology of the Pagan poets, or in the extravagant opinions of philoſophers; for he perpetually throws ſuch ridicule on the gods and philoſophers, with their vices, as inſpires hatred and contempt for them; but it cannot be ſaid that he writes any where againſt an over-ruling providence.

LUCIANISTS, or Lucanists, a religious ſect, ſo called from Lucianus, or Lucanus, a heretic of the ſecond century, being a diſciple of Marcion, whoſe errors he followed, adding ſome new ones to them. Epiphanius ſays he abandoned Marcion, teaching that people ought not to marry, for fear of enriching the Creator: and yet other authors mention that he held this error in common with Marcion and other Gnoſtics. He denied the immortality of the ſoul; aſſerted it to be material.

There was another ſect of Lucianiſts, who appeared ſome time after the Arians. They taught, that the Father had been a Father always, and that he had the name even before he begot the Son; as having in him the power or faculty of generation: and in this manner they accounted for the eternity of the Son.

LUCID intervals, the fits of Lunatics or maniacs, wherein the phrenzy leaves them in poſſeſſion of their reaſon.

LUCIFER, according to the poets, was the ſon of Jupiter and Aurora: in aſtronomy, Lucifer is the bright planet Venus, which either goes before the ſun in the morning, and is our morning ſtar; or in the evening follows the ſun, and then is called *Heſperus* or the evening ſtar.

LUCIFERA, in mythology, a ſurname given to Diana, under which title ſhe was invoked by the Greeks in childhood. She was repreſented as covered with a large veil, interſperſed with ſtars, bearing a creſcent on her head, and holding in her hand a lighted flambeau.

LUCIFERIANS, a religious ſect, who adhered to the ſchiſm of Lucifer, biſhop of Cagliari, in the fourth century, who was baniſhed by the emperor Conſtantius for having defended the Nicence doctrine concerning the three perſons in the godhead.—St Auguſtine ſeems to intimate, that they believed the ſoul, which they conſidered as of a carnal nature, to be tranſmitted to the children from their fathers. Theodoret ſays, that Lucifer was the author of a new error. The Luciferians increaſed mightily in Gaul, Spain, Egypt, &c. The occaſion of the ſchiſm was, that Lucifer would not allow any acts he had done to be aboliſhed. There were but two Luciferian biſhops, but a great number of prieſts and deacons. The Luciferians bore a peculiar averſion to the Arians.

LUCILIUS (Caius), a Roman knight, and a Latin poet, was born at Sueſſa in Italy, about 140 B. C. He ſerved under Scipio Africanus in the war with the Numantines; and was in great favour with that celebrated general, and with Lælius. He wrote 30 books of ſatires, in which he laſhed ſeveral perſons of quality very ſharply. Some learned men aſcribe the invention of ſatire to him; but M. Dacier has maintained, with great probability, that Lucilius only gave a better turn to that kind of poetry, and wrote it with more wit and humour than his predeceſſors Ennius and Pacuvius had done. His fragments have been carefully collected by Francis Douza at Leyden in 1599, with notes. But they require ſtill to be better illuſtrated by ſome learned critic.

LUCINA, a goddeſs among the Romans, who preſided over women in labour. Some take her to be Diana, others Juno. She is called *Lucina,* becauſe ſhe brought children to the light; from the Latin word *lux*, "light."

LUCIUS, in ichthyology. See Esox.

LUCONIA. See MANILA.

LUCOPHEREA, in ichthyology. See PERCA.

LUCRETIA, the famous Roman matron, wife of Collatinus, and the cauſe of the revolution in Rome from a monarchy to a republic; this lady being raviſhed by Sextus, the eldeſt ſon of Tarquin king of Rome, ſtabbed herſelf, 509 B. C. See the article CHASTITY. The bloody poignard, with her dead body expoſed to the Senate, was the ſignal of Roman liberty; the expulſion of the Tarquins, and abolition of the regal dignity, was inſtantly reſolved on, and carried into execution. See ROME.

LUCRETIUS, or TITUS LUCRETIUS CAIUS, one of the moſt celebrated of the Roman poets, was born of an ancient and noble Latin family, and ſtudied at Athens, where he became one of Epicurus's ſect. He acquired great reputation by his learning and eloquence; but in the flower of his age fell into a frenzy, occaſioned by a philtre given him by his wife, who was diſtractedly fond of him. Lucretius, during the intervals of his madneſs, put Epicurus's doctrines into verſe, and compoſed his ſix books *De rerum natura,* which are ſtill extant. It is ſaid, that he killed himſelf in a fit of madneſs, in the 54th year before the Chriſtian æra, when 51 years old. The moſt correct edition of Lucretius is that of Simon de Coline. The cardinal de Polignac has refuted Lucretius's arguments in his excellent Latin poem intitled *Anti-Lucretius.* His poem *De rerum natura* has been tranſlated into Engliſh by Mr Creech.

LUCRINUS LACUS (anc. geog.), a lake of Campania, between Baiæ and Puteoli, famous for its oyſters (Horace, Martial, Juvenal); *Lucrinenſes* (Cicero), the people dwelling on it. Now a perfect bay ſince the earthquake in 1538.

LUCULLUS (Lucius Lucinius), a Roman general, celebrated for his eloquence, his victories, and his riches. In his youth he made a figure at the bar; and being afterwards made quæſtor in Aſia, and prætor in Africa, governed thoſe provinces with great moderation and juſtice. Scarce was he known as a military man, when he twice beat the fleet of Amilcar, and gained two great victories over him. His happy genius was greatly improved by ſtudy; for he employed his leiſure in reading the beſt authors on military affairs. Being made conſul with Aurelius Cotta, during the third war with Mithridates king of Pontus, he was ſent againſt this prince: and this expedition was attended with a ſeries of victories, which did him leſs honour than an act of generoſity towards his colleague; who, willing to take advantage of his abſence to ſignalize himſelf by ſome great exploit, haſtened to fight Mithridates; but was defeated and ſhut up in Calcedonia, where he muſt have periſhed, if Lucullus, ſacrificing his reſentment to the pleaſure of ſaving a Roman citizen, had not flown to his aſſiſtance, and diſengaged him. All Pontus then ſubmitted to Lucullus; who being continued in his government of Aſia, entered the territories of Tigranes, the moſt powerful king in Aſia. That prince marched with a formidable army againſt Lucullus: who defeated him with a handful of men, and killed great numbers of his forces; took Tigranocertes, the capital of his kingdom; and was ready to put an end to the war, when the intrigues of a tribune got him depoſed, and Pompey nominated in his room. Lucullus having brought home prodigious riches, now gave himſelf up to exceſſive luxury; and his table was ſerved with a profuſion till that time unknown. He brought from the Eaſt a great number of books, which he formed into a library, and gave admittance to all men of learning, who frequented it in great numbers. Towards the end of his life, he fell into a kind of madneſs; and Lucullus, his brother, was appointed his guardian. He is ſaid to have been the firſt who brought cherries into Europe, having brought the grafts from the kingdom of Pontus.

LUCUS, in general, denotes a wood or grove ſacred to a deity; ſo called *à lucendo,* becauſe a great number of lights were uſually burning in honour of the god (Iſidorus); a practice common with idolaters, as we learn from Scripture: hence Homer's αγλαον αλσος.

LUD, a Britiſh king mentioned in our old chronicles, and ſaid to have reigned about the year of the world 3878. He is reported to have enlarged and walled about *Troynovant,* or New Troy, where he kept his court, and made it his capital. The name of *London* is hence derived from *Lud's town,* and *Ludgate,* from his being buried near it: but this is only one among many other derivations of the name of London; which are at leaſt equally probable. See LONDON.

LUDI, a term uſed for ſhows and public repreſentations made by the Romans, for the entertainment of the people. See GAMES.

For an account of the particular games of Greece and Rome, as the Iſthmian, Nemæan, Olympic, &c. See ISTHMIAN, *&c.*

LUDIUS, a celebrated painter, lived in the reign of Auguſtus Cæſar, and excelled in grand compoſitions. He was the firſt who painted the fronts of houſes in the ſtreets of Rome; which he beautified with great variety of landſcapes, and many other different ſubjects.

LUDLOW (Edmund), ſon of Sir Henry Ludlow was born at Maidenhead, and educated in Trinity college, Oxford. His father oppoſing the king's intereſt, Mr Ludlow joined with the ſame party, and was preſent at the battle of Edgehill as a volunteer under the earl of Eſſex. Upon the death of his father, he was choſen knight of the ſhire for Wilts, and obtained the command of a regiment of horſe for the defence of that county. He was one of king Cha. I.'s judges: after whoſe death he was ſent by the parliament into Ireland, in quality of lieutenant-general of the horſe; which employment he diſcharged with diligence and ſucceſs till the death of the lord-deputy Ireton, when he acted for ſome time as general, though without that title; Cromwell, who knew him to be ſincerely in the intereſt of the commonwealth, always finding out ſome pretext to hinder the conferring of that character upon him. The laſt ſtroke had been given by Ludlow to the Iriſh rebellion, if the uſurpation of Cromwell had not prevented it. Under his power he never acted; and though Cromwell uſed his utmoſt efforts, he remained inflexible. After Cromwell's death, he endeavoured to reſtore the commonwealth; but Charles II. being recalled, he thought proper to conceal himſelf, and eſcaped into Switzerland, where he ſettled. After the revolution, he came over into England, in order to be employed in Ireland againſt King James: but appearing publicly in London, it gave great offence; and an addreſs was preſented by Sir Edward Seymour to King William III. for a proclamation in order to apprehend Colonel Ludlow, attainted for the murder of King Charles I. Upon this he returned to Switzerland, where he died. During his retirement in Switzerland he wrote his Memoirs.

Ludlow, a town of Shropſhire in England, ſituated at the conflux of the Teme and Corve, 18 miles from Shrewſbury, and 138 from London. The preſident of the council of the marches, eſtabliſhed by Henry VIII. generally kept his courts in it, by which the town was much benefited, theſe courts not having been aboliſhed till the 1ſt of William and Mary. Its neighbourhood to Wales makes it a great thoroughfare, and engages many of the Welch to ſend their children of both ſexes to it for education. It was incorporated by Edward IV. and among other privileges has that of trying and executing criminals within itſelf. It is one of the neateſt towns in England, with walls and ſeven gates. It is divided into four wards; and is governed by 2 bailiffs, 12 aldermen, 25 common-councilmen, a recorder, a town clerk, ſteward, chamberlain, coroner, &c. From the caſtle on the top of the hill on which the town ſtands is a moſt delightful proſpect. In an apartment of the outer gatehouſe Samuel Butler is ſaid to have written the firſt part of Hudibras. Of this caſtle, which was beſieged and taken by King Stephen ſome of the offices are fallen down, and great part of it turned into a bowling-green; but part of the royal apartments and the ſword of ſtate are ſtill left. The walls were at firſt a mile in compaſs, and there was a lawn before it for near two miles, of which much is now incloſed. The battlements are very high and thick, and adorned with towers. It has a neat chapel, where are the coats of arms of abundance of Welch gentry, and over the ſtable doors are the arms of Queen Elizabeth, the earls of Pembroke, &c. This caſtle was a palace of the prince of Wales, in right of his principality. The river Teme has a good bridge over it, ſeveral wears acroſs it, and turns a great many mills. Here is a large parochial church, which was formerly collegiate; in the choir whereof is an inſcription relating to Prince Arthur, elder brother to King Henry VIII. who died here, and whoſe bowels were here depoſited, though it is ſaid his heart was taken up ſome time ago in a leaden box. In this choir is a cloſet, commonly called *God's Houſe*, where the prieſts uſed to keep their conſecrated utenſils; and in the market-place is a conduit, with a long ſtone croſs on it, and a niche wherein is the image of St Laurence, to whom the church was dedicated. On the north ſide of the town there was a rich priory, whereof there are few ruins to be ſeen except thoſe of its church. Here are an alms-houſe for 30 poor people, and two charity-ſchools where 50 boys and 30 girls are both taught and clothed. It has a market on Monday, and three leſſer ones on Wedneſday, Friday, and Saturday. Its fairs are on the Tueſday Eaſter, Whit-Wedneſday, Auguſt 21. Sept. 28. and Dec. 8. Proviſions are very cheap here; and at the annual horſe-races there is the beſt of company. The country round is exceedingly pleaſant, fruitful, and populous, eſpecially that part called the *Corveſdale*, being the vale on the banks of the river Corve. Ludlow ſends two members to parliament.

LUDOLPH (Job), a very learned writer of the 17th century, was born at Erfurt in Thuringia. He travelled much, and was maſter of 25 languages; viſited libraries, ſearched after natural curioſities and antiquities every where, and converſed with learned men of all nations. He publiſhed A Hiſtory of Ethiopia, and other curious books.

Ludolph (Henry William), nephew of Job abovementioned, was born at Erfurt in 1655. He came over to England as ſecretary to M. Lenthe, envoy from the court of Copenhagen to that of London; and being recommended to Prince George of Denmark, was received as his ſecretary. He enjoyed this office for ſome years, until he was incapacitated by a violent diſorder; when he was diſcharged with a handſome penſion: after he recovered, he travelled into Muſcovy, where he was well received by the czar, and where his knowledge made the Muſcovite prieſts ſuppoſe him to be a conjuror. On his return to London in 1694, he was cut for the ſtone; and as ſoon as his health would permit, in acknowledgment of the civilities he had received in Muſcovy, he wrote a grammar of their language, that the natives might learn their own tongue in a regular method. He then travelled into the Eaſt, to inform himſelf of the ſtate of the Chriſtian church in the Levant; the deplorable condition of which induced him, after his return, with the aid of the biſhop of Worceſter, to print an edition of the New Teſtament in the vulgar Greek, to preſent to the Greek church. In 1709, when ſuch numbers of Palatines came over to England, Mr Ludolph was appointed by Queen Anne one of the commiſſioners to manage the charities raiſed for them; and he died early, the following year. His collected works were publiſhed in 1712.

LUDWIDGIA, in botany: A genus of the monogynia order, belonging to the tetrandria claſs of plants; and in the natural method ranking under the 17th order, *Calycanthemæ*. The corolla is tetrapetalous; the calyx quadripartite, ſuperior; the capſule tetragonal, quadrilocular, inferior, and polyſpermous.

LUES, among phyſicians, is in general uſed for a diſeaſe of any kind; but in a more particular ſenſe is reſtrained to contagious and peſtilential diſeaſes: thus the *lues Gallica*, or *venerea*, ſignifies the venereal diſeaſe. See Medicine-*Index*.

LUFF, the order from the pilot to the ſteerſman to put the helm towards the *lee*-ſide of the ſhip, in order to make the ſhip ſail nearer the direction of the wind. Hence, luff round, or luff a-lee, is the exceſs of this movement, by which it is intended to throw the ſhip's head up in the wind, in order to tack her, &c. A ſhip is accordingly ſaid to ſpring her luff when ſhe yields to the effort of the helm, by ſailing nearer to the line of the wind than ſhe had done before. See alſo *Hauling the Wind*.

Luff-Tackle, a name given by ſailors to any large tackle that is not deſtined for a particular place, but may be variouſly employed as occaſion requires. It is generally ſomewhat larger than the jigger tackle, although ſmaller than thoſe which ſerve to hoiſt the heavier materials into and out of the veſſel, which latter are the main and fore-tackles, the ſtay and quarter-tackles, &c.

LUG-sail, a ſquare-ſail, hoiſted occaſionally on the maſt of a boat or ſmall veſſel upon a yard which hangs nearly at right angles with the maſt. Theſe are more particularly uſed in the barca longas, navigated by the Spaniards in the Mediterranean.

LUGDUNUM (anc. geog.), the capital of the Seguſiani in Gallia Celtica, ſituated at the conflux of the Arar and Rhodanus; on an eminence, as the Celtic term *dune* ſignifies; built by Manutius Plancus under Auguſtus, while commanding in that part of Gaul; and whither he led a colony. Now *Lyons*, capital of and Lyonois.

Lugdunum Batavorum (anc. geog), a town of the Batavi in Gallia Belgica. Now *Leyden* in Holland.

Lugdunum Converarum (anc. geog.), a town of Gaul in Aquitain, at the foot of the Pyrenees. Now *S. Bertrand*, in Gaſcony.

LUGEUS lacus (anc. geog.), a lake of Japydia, the weſtmoſt diſtrict of Illyricum, to the ſouth of the Save, and near the head of the Arſia. Now commonly called the *Zirichnitz Lake*, from a ſmall adjoining town. It is locked on every ſide with mountains; from which ſcanty currents run down; the leſs in quantity their waters, becauſe drank up by the earth; till at length they are ſwallowed up in rocky furrows, ſo formed as to reſemble artificial. In theſe the water being ſo redundant as to refuſe receiving any more, they regurgitate, and return the water with extraordinary celerity; which thus ſpreading itſelf, forms a lake, in moſt places 18 cubits high. Theſe waters afterwards retire with no leſs celerity than they came on, not only through the furrows, but paſs through the whole of the bottom, as through a ſieve; which when perceived by the inhabitants, they directly ſtop up the larger apertures, and thus take large quantities of fiſh: when the lake is dry, they cut down their harveſt on the ſpot where they ſowed, and ſow again before the inundation comes on: and graſs ſhoots ſo quick on it, that it may be cut down in three weeks time (Lazius, Wernherus).

LUGGERSHALL, a borough of Wiltſhire, 12 miles north of Saliſbury, and 75 north by weſt of London. It is an ancient borough by preſcription, though but a ſmall hamlet, near the foreſt of Chute, in a delightful country; and was the reſidence of ſeveral kings. It had formerly a caſtle. It is governed by a bailiff choſen yearly at the lord of the manor's court-leet. On the neighbouring downs there uſed to be horſe-races. It has a fair on the 25th of July, and ſends two members to parliament.

LUKE (St), the evangeliſt, and the diſciple of the apoſtles, was originally of Antioch in Syria, and by profeſſion a phyſician. He particularly attached himſelf to St Paul, and was his faithful companion in his travels and labours. He went with him to Troas in Macedonia about the year 51. He wrote his Goſpel in Achaia about the year 53; and, ten years after, the Acts of the Apoſtles, which contains a hiſtory of 30 years. Of all the inſpired writers of the New Teſtament, his works are written in the moſt elegant Greek. It is believed that St Luke died at Rome, or in Achaia.

Goſpel of St Luke, a canonical book of the New Teſtament. Some think that it was properly St Paul's Goſpel; and that, when the apoſtle ſpeaks of *his* Goſpel, he means what is called *St Luke's*. Irenæus ſays, that St Luke digeſted into writing what St Paul preached to the Gentiles; and Gregory Nazianzen tells us, that St Luke wrote with the aſſiſtance of St Paul.

St Luke the Evangeliſt's Day, a feſtival in the Chriſtian church, obſerved on the 18th of October.

LULA, a town of Swediſh Lapland; ſeated at the mouth of the river Lula, on the weſt ſide of the gulph of Bothnia, 42 miles ſouth-weſt of Tornea. E. Long. 21. 0. N. Lat. 64. 30.

Lula Lapmark, a province of Swediſh Lapland; bounded by that of Tornea on the north, by the Bothnic Gulph on the eaſt, by Pithia Lapmark on the ſouth, and Norway on the weſt.

LULLI (John Baptiſt), the moſt celebrated and moſt excellent muſician that has appeared in France ſince the revival of learning, was born at Florence. He was taken to France when very young by a perſon of quality; and he carried the art of playing on the violin to the higheſt perfection. Louis XIV. made him ſuperintendant of muſic. Some time after Perinna having introduced operas into France, and quarrelling with his company, he reſigned his privilege to Lulli. Operas were then carried to the utmoſt perfection by this celebrated muſician, and were attended with continual applauſe. Lulli every year, after this time, gave a piece of his own compoſition, till his death, which happened in 1687.

LULLY (Raymond), a famous writer, ſurnamed the *Enlightened Doctor*, was born in the iſland of Majorca in 1225. He applied himſelf with indefatigable labour to the ſtudy of the Arabian philoſophy, to chemiſtry, phyſic, and divinity; and acquired great reputation by his works. He at length went to preach the goſpel in Africa; and was ſtoned to death in Mauritania, at the age of 80. He is honoured as a martyr at Majorca, whither his body was carried. He wrote many treatiſes on all the ſciences, in which he ſhows much ſtudy and ſubtilty, but little judgment or ſolidity. A complete edition of his works has been printed at Mentz.—He ought not to be confounded with Raymond Lully of Terraca, ſurnamed *Neophyta*, who from being a Jew turned Dominican friar. This laſt Lully maintained ſeveral opinions that were condemned by Pope Gregory XI.

LUMBAGO, a fixed pain in the ſmall of the back. See Medicine-*Index*.

LUMBARIS, a name given to the arteries and veins which ſpread over the loins.

LUMBRICAL, a name given to four muſcles of the fingers and to as many of the toes.

LUMBRICUS, the Worm, in zoology; a genus of inſects belonging to the order of vermes inteſtini. The body is cylindrical, annulated, with an elevated belt near the middle, and a vent-hole on its ſide. There are two ſpecies of this animal.

1. Lumbricus terreſtris, the earth or dew worm, Mr Barbut obſerves, differs extremely in colour and external appearance in the different periods of its growth, which has occaſioned people little acquainted with the variations of this kind of animals to make four or five different ſpecies of them: The general colour is a duſky red.—They live under ground, never quitting the earth but after heavy rains or at the approach of ſtorms, and in the ſeaſon of their amours. The method to force them out is, either to water the ground with infuſions of bitter plants, or to trample on it. The bare motion on the ſurface of the ſoil drives them up, in fear of being ſurpriſed by their formidable enemy the mole. The winding progreſſion of the worm is facilitated by the inequalities of its body, armed with ſmall, ſtiff, ſharp pointed briſtles: when it means to inſinuate itſelf into the earth, there oozes from its body a clammy liquor, by means of which it ſlides down. It never damages the roots of vegetables. Its food is a ſmall portion of earth, which it has the faculty of digeſting: The ſuperfluity is ejected by way of excrement, under a vermicular appearance. Earth-worms are hermaphrodites, and have the parts of generation placed near the neck: their copulation is performed on the ground; nothing being more uſual than to ſee it full of holes, which holes are thought to be made by thoſe kind of worms coming to the ſurface in queſt of females. During their coition they would ſooner ſuffer themſelves to be cruſhed than parted.

Plate CCLXXIV. 2. The marinus, marine worm, or lug, is of a pale red colour, and the body is compoſed of a number of annular joints; the ſkin is ſcabrous, and all the rings or joints are covered with little prominences, which render it extremely rough to the touch. It is an inhabitant of the mud about the ſea-ſhores, and ſerves for food to many kinds of fiſh: ſurpriſing large ones are to be met with about the Bognor rocks in Suſſex, England. The fiſhermen bait their hooks and nets with it.

For the effects of theſe animals in the human body, and the method of expelling them, See MEDICINE-*Index*.

LUMELLO, a village in Italy, which gives name to the Lumellin, a ſmall diſtrict in the duchy of Milan, lying along the river Po, and of which Mortaria and Valencia are the principal places. It was ceded to the duke of Savoy in 1707, and confirmed by the treaty of Utrecht in 1713. E. Long. 8. 42. N. Lat. 45. 5.

LUMINOUS, an epithet applied to any thing that ſhines or emits light.

Luminous Emanations, have been obſerved from human bodies, as alſo from thoſe of brutes. The light ariſing from currying a horſe, or from rubbing a cat's back, are known to moſt. Inſtances of a like kind have been known on combing a woman's head. Bartholin gives us an account, which he intitles *mulier reſplendens*, of a lady in Italy whoſe body would ſhine whenever ſlightly touched with a piece of linen. Theſe effluvia of animal bodies have many properties in common with thoſe produced from glaſs; ſuch as their being lucid, their ſnapping, and their not being excited without ſome degree of friction; and are undoubtedly electrical, as a cat's back has been found ſtrongly electrical when ſtroaked. See ELECTRICITY, and LIGHT.

LUMINOUSNESS OF THE SEA. See LIGHT, and SEA.

Luminouſneſs of Putreſcent Subſtances. See LIGHT.

LUMP-FISH. See CYCLOPTERUS.

LUNA (anc. geog.), a foreſt of Germany, at no great diſtance from the Hercynia; below which were the Boemi: it was therefore in Moravia, near the ſprings of the Marus, now March, which runs into the Danube over againſt Carnuntum.

LUNA, or *Lunna*, a town of Gallia Celtica. Now *Clugny* in Burgundy.

LUNA, a town and port of Liguria, at the mouth of the Marca. The town was but ſmall, but the port large and beautiful, according to Strabo. Now extinct, and its ruins called *Luna Diſtrutta*. It was famous for its quarries of white marble, thence called *Lunenſe*; and for its cheeſe, remarkable rather for its ſize than goodneſs, each being a thouſand weight.

LUNA, in aſtronomy, the moon. See ASTRONOMY, *paſſim*.

LUNA, in the jargon of alchemiſts, ſignifies *ſilver*; ſo called from the ſuppoſed influence of the moon thereupon.

LUNACY, a ſpecies of madneſs. See LUNATIC, and MEDICINE-*Index*.

Luna Cornea, in chemiſtry, is the combination of marine acid with ſilver. See CHEMISTRY-*Index*.

LUNACY, in law. See IDIOCY, and LUNATIC.

LUNÆ MONS (anc. geog.), a promontory of Luſitania. Now *Rock of Liſbon*. W. Long. 10. N. Lat. 38. 50.—Another *Lunæ Mons* of Ethiopia, from which the Nile was ſuppoſed to take its riſe.

Lunæ Portus, a very extenſive port, or more truly a bay, of Liguria, between Portus Veneris and Portus Ericis, 20 miles in compaſs. Now *il Golfo della Spezia* on the eaſt coaſt of the territory of Genoa.

LUNAR, ſomething relating to the MOON.

Lunar Month. See MONTH.

Lunar Year, conſiſts of 354 days, or 12 ſynodical months. See YEAR.

Lunar Dial. See DIALLING.

LUNARE os, in anatomy, is the ſecond bone in the firſt row of the carpus. It has its name from the Latin, *luna* "the moon," becauſe one of its ſides is in the form of a creſcent.

LUNARIA, SATTIN-FLOWER, or *Moonwort*, in botany: A genus of the ſiliculoſa order, belonging to the tetradynamia claſs of plants; and in the natural method ranking under the 39th order, *Siliquoſæ*. The ſilicula is entire, elliptical, compreſſed-plane, and pedicellated; with the valves equal to the partition, parallel and plane; the leaves of the calyx are alternately fritted at the baſe. This plant is famous in ſome parts of England for its medicinal virtues, though it has not the fortune to be received in the ſhops. The people in the northern countries dry the whole plant in an oven, and give as much as will lye on a ſhilling for a doſe twice a-day in hemorrhages of all kinds, particularly in the too abundant flowing of the menſes, and with great ſucceſs. The Welch, among whom it is not uncommon, Dr Needham informs us, make an ointment of it, which they uſe externally, and pretend it cures dyſenteries.

LUNARIUM (anc. geog.), a promontory of the Hither Spain, between Blanda and Bætulo. Commonly called *el Cabo de Palaſugel*, in Catalonia, on the Mediterranean; or *Cabo de Toſa*, on the ſame coaſt, and in Catalonia, 15 miles from the former, to the weſt.

LUNATIC, a perſon affected with that ſpecies of madneſs termed *lunacy*. The word is indeed properly applied to one that hath lucid intervals; ſometimes enjoying his ſenſes, and ſometimes not; and that frequently ſuppoſed to depend on the influence of the moon.

LUNATIC, in law. Under the general term of *non compos mentis* (which Sir Edward Coke ſays is the moſt legal name) are comprized not only lunatics, but perſons under frenzies, or who loſe their intellects by diſeaſe; thoſe that *grow* deaf, dumb, and blind, not being *born* ſo; or ſuch, in ſhort, as are judged by the court of chancery incapable of conducting their own affairs. To theſe alſo, as well as idiots, the king is guardian, but to a very different purpoſe. For the law always imagines, that theſe accidental misfortunes may be removed, and therefore only conſtitutes the crown a truſtee for the unfortunate perſons, to protect their property, and to account to them for all profits received, if they recover, or after their deceaſe to their repreſentatives. And therefore it is declared by the ſtatute 17 Edw. II. c. 10. that the king ſhall provide for the cuſtody and ſuſtentation of lunatics, and preſerve their lands, and the profits of them, for their uſe when they come to their right mind; and the king ſhall take nothing to his own uſe: and if the parties die in ſuch eſtate, the reſidue ſhall be diſtributed for their ſouls by the advice of the ordinary, and of courſe (by the ſubſequent amendments of the law of adminiſtrations) ſhall now go to their executors or adminiſtrators.

On the firſt attack of lunacy or other occaſional inſanity, when there may be hopes of a ſpeedy reſtitution of reaſon, it is uſual to confine the unhappy objects in private cuſtody under the direction of their neareſt friends and relations: and the legiſlature, to prevent all abuſes incident to ſuch private cuſtody, hath thought proper to interpoſe its authority, by 14 Geo. III. c. 49. for regulating private madhouſes. But when the diſorder is grown permanent, and the circumſtance of the party will bear ſuch additional expence, it is thought proper to apply to the royal authority to warrant a laſting confinement.

The method of proving a perſon *non compos* is very ſimilar to that of proving him an idiot. The lord chancellor, to whom, by ſpecial authority from the king, the cuſtody of idiots and lunatics is intruſted, upon petition or information, grants a commiſſion in nature of the writ *de idiota inquirendo*, to inquire into the party's ſtate of mind; and if he be found *non compos*, he uſually commits the care of his perſon, with a ſuitable allowance for his maintenance to ſome friend, who is then called his committee. However, to prevent ſiniſter practices, the next heir is ſeldom permitted to be of this committee of the perſon; becauſe it is his intereſt that the party ſhould die. But, it hath been ſaid, there lies not the ſame objection againſt his next of kin, provided he be not his heir; for it is his intereſt to preſerve the lunatic's life, in order to increaſe the perſonal eſtate by ſavings, which he or his family may hereafter be entitled to enjoy. The heir is generally made the manager or committee of the eſtate, it being his intereſt, by good management to keep it in condition: accountable, however, to the court of chancery, and to the *non compos* himſelf, if he recovers; or otherwiſe, to his adminiſtrators. See IDIOCY.

LUNATION, the period or ſpace of time between one new moon and another; alſo called *ſynodical month*. See CYCLE and EPACT.

LUNDEN, or LUND, a conſiderable town of Sweden in Gothland; and capital of the territory of Schonen, with an archbiſhop's ſee and an univerſity. It was ceded to the Swedes by the Danes in 1658. E. Long. 13. 25. N. Lat. 55. 40.

LUNDY-ISLAND, ſituated 50 miles in the ſea, off the N. W. coaſt of Devonſhire, is 5 miles long and 2 broad, but ſo encompaſſed with inacceſſible rocks, that it has but one entrance to it, ſo narrow that two men can ſcarce go abreaſt. It is reckoned in the hundred of Branton. It had once both a fort and a chapel. The ſouth part of it is indifferent good ſoil, but the north part of it is barren, and has a high pyramidical rock called the Conſtable. Here are horſes, kine, hogs, and goats, with great ſtore of ſheep and rabbits; but the chief commodity is fowl, with which it abounds much, their eggs being very thick on the ground at their ſeaſon of breeding. No venomous creature will live in this iſland. In the reign of King Henry VIII. one William Moriſco, who had conſpired to murder him at Woodſtock, fled to this iſland, which he fortified, turned pirate, and did much damage to this coaſt, but was taken by ſurprize at length, with 16 of his accomplices, and put to death.

LUNE, LUNULA, in *Geometry*, a plane in form of a creſcent or half-moon, terminated by the circumference of two circles, that interſect each other within.

LUNENBURG, or LUNEBURG *Zell*, a principality of Germany, bounded to the ſouth by that of Calenberg, the dioceſe of Hildeſheim, and the duchy of Brunſwic; to the north by the duchy of Lauenburg and the Elbe, by the laſt of which it is ſeparated from the territory of the imperial city of Hamburg; to the eaſt, by the duchy of Brunſwic, the Alte Mark, and the duchy of Mecklenburg; and to the weſt, by the duchies of Bremen and Verden, the county of Hoya, and the principality of Calenberg. The ſoil, except along the Elbe, Aller, and Jetz, is either ſand, heath, or moors. In the more fruitful parts of it are produced wheat, rye, barley, oats, peaſe, buck wheat, flax, hemp, hops, pulſe, oak, beech, firs, pines, birch, and alder, together with black cattle and horſes. The heaths abounds with bees and honey, and a ſmall kind of ſheep whoſe wool is long and courſe. Lunenburg is well furniſhed with ſalt ſprings and limeſtone, and the foreſt of Gorde with veniſon. The rivers Elbe, Ilmenau, and Aller, are navigable; and, conſequently very advantageous to the country, independent of the fiſh which they yield. The general diets of this principality are convened by the ſovereign twice a year, and held at Zell. They conſiſt of the deputies of the nobility and the towns of Lunenburg, Uelzen, and Zell, who have the nomination of the members of the high colleges, and other officers, jointly with the ſovereign. There are near 200 Lutheran churches in the country, under two general and 15 ſubordinate ſuperintendants, ſeveral grammar-ſchools, two Calviniſt churches at Zell, and an academy of exerciſes at Lunenburg. The manufactures are chiefly linen cloth, cottons, ribbons, ſtockings, hats, ſtarch, bleached wax, refined ſugar, gold and ſilver wires, all kinds of wooden wares, barges, boats, and ſhips. The exports of theſe to Hamburg, Lubec, and Altena, are conſiderable. The neighbourhood of theſe cities, with the facility of conveying goods and merchandize to them and other places; either by land or water, is very advantageous to this country, and contributes greatly to its ſubſiſtence. On account of this principality, the king of Great Britain has a ſeat and voice both in the college of the princes of the empire and of the circle of Lower Saxony. Its quota in the Matricula is 20 horſes and 120 foot, or 720 florins in lieu of them. The revenue of the principality ariſe chiefly from the demeſnes, tolls on the Elbe, contributions, duties on cattle, beer, wine, brandy, and other commodities, which altogether muſt be very conſiderable, ſome bailiwicks alone yielding upwards of 20,000 rixdollars.

LUNENBURGH, the capital of the principality of the ſame name, is a pretty large town of Germany, on the river Elmen, or the Ilmenau, which is navigable from the town to the Elbe, at the diſtance of 13 miles. It is 27 miles from Hamburgh, 43 from Zell, 65 from Brunſwick, 76 from Bremen, 68 from Hanover; and ſtands in E. Long. 10. 40. N. Lat. 53. 28. Its inhabitants are reckoned at between 8000 and 9000. Formerly this town was one of the Hanſe, and an imperial city. Some derive its name from *Lina*, the ancient name of the Ilmenau; others from *Luna* the moon, an image of which is ſaid to have been worſhipped by the inhabitants in the times of Paganiſm. Here were anciently ſeveral convents, viz. one of minims, another of Premonſtratenſians, another of Benedictines, and a fourth of Minorites. Out of the revenues of the Benedictine monaſtery was founded an academy for the martial exerciſes, where young gentlemen of the principality of Lunenburg are maintained gratis, and taught French, fencing, riding, and dancing; but foreigners are educated at a certain fixed price. A Latin ſchool was alſo founded, conſiſting of four claſſes, and well endowed out of theſe revenues. The ſuperintendency and management of theſe, and the eſtates appropriated to their maintenance, belongs to the landſchaft director, and the aufreiter, who are both choſen from among the Lunenburg nobility. The firſt came in place of the Popiſh abbot, and as ſuch is head of the ſtates of the principality, and preſident of the provincial college. He has the title of *excellency*; and in public inſtruments ſtyles himſelf, *by the grace of God landſchaft director*, and *lord of the manſion of St Michael in Lunenburg*. The chief public edifices are three pariſh-churches, the ducal palace, three hoſpitals, the town-houſe, the ſalt-magazine, the anatomical theatre, the academy; the conventual church of St Michael, in which lie interred the ancient dukes; and in which is the famous table eight feet long, and four wide, plated over with chaſed gold, with a rim embelliſhed with precious ſtones, of an immenſe value, which was taken from the Saracens by the emperor Otho, and preſented to this church; but in 1698, a gang of thieves ſtripped it of 200 rubies and emeralds, together with a large diamond, and moſt of the gold, ſo that at preſent but a ſmall part of it remains. Here are ſome very rich ſalt ſprings. Formerly, when there was a greater demand for the ſalt, upwards of 120,000 tons have been annually boiled here, and ſold off: but ſince the commencement of the preſent century, the ſalt trade hath declined greatly. A fifth of the ſalt made here belongs to the king, but is farmed out. It is ſaid to excel all the other ſalt made in Germany. This town is well fortified; and has a garriſon, which is lodged in barracks. In the neighbourhood is a good limeſtone quarry; and along the Ilmenau are ware-houſes in which are lodged goods brought from all parts of Germany, to be forwarded by the Ilmenau to Hamburg, or by the Aſche to Lubec, from whence other goods are brought back the ſame way. The town itſelf drives a conſiderable traffic in wax, honey, flax, linen, ſalt, lime, and beer.

LUNENSE MARMOR, in the natural hiſtory of the ancients, the name of that ſpecies of white marble now known among us by the name of the *Carrara-marble*, and diſtinguiſhed from the ſtatuary kind by its greater hardneſs and leſs ſplendour. It was ever greatly eſteemed in building and ornamental works, and is ſo ſtill. It is of a very cloſe and fine texture, of a very pure white, and much more tranſparent than any other of the white marbles. It has always been found in great quantities in Italy, and is ſo to this day. See LUNA

LUNETTE, in fortification, an inveloped counter-guard, or elevation of earth, made beyond the ſecond ditch, oppoſite to the places of arms; differing from the ravelins only in their ſituation. *Lunettes* are uſually made in ditches full of water, and ſerve to the ſame purpoſe as fauſſebrays, to diſpute the paſſage of the ditch. See FORTIFCATION.

LUNETTE, in the manege, is a half horſe-ſhoe, or ſuch a ſhoe as wants the ſpunge, *i. e.* that part of the branch which runs towards the quarters of the foot.

LUNETTE is alſo the name of two ſmall pieces of felt, made round and hollow, to clap upon the eyes of a vicious horſe that is apt to bite, and ſtrike with his fore feet, or that will not ſuffer his rider to mount him.

LUNGS, in anatomy, a part of the human body, ſerving for reſpiration. See ANATOMY, n° 117.

In the *Journal de Medicine* for June 1789 is a deſcription of an

Inſtrument for Inflating the LUNGS, invented by M. Gorcy phyſician to the military hoſpital at Neufbriſack, which appears to be extremely well adapted to the purpoſe, whilſt it may be uſed with the greateſt eaſe and facility.

This inſtrument, which the inventor ſtyles *apodopic*, that is, "reſtorer of reſpiration conſiſts of a double pair of bellows, BCLM, fig. 1, the two different parts of which have no communication with each other. In the lower ſide B M is an aperture A for a valve conſtructed on the principles of thoſe of Mr Nairne's air-pump. It conſiſts of a rim of copper, cloſed at one end by a plate of the ſame metal, in which plate are ſeven ſmall holes placed at equal diſtances. This plate is

Plate CCLXXV.

is covered with a piece of ſilk coated with elaſtic gum, in which are ſix tranſverſe inciſions of two or three lines in length. Each inciſion is ſo made as to be ſituated between two of the holes, and at an equal diſtance from each: *ſee* D, fig. 2. The ſilk muſt be made very ſecure, by a thread paſſing ſeveral times round the rim. It is obvious, that a ſtream of air applied to that ſide of the plate which is oppoſite to the ſilk, will paſs through the holes, and, lifting up the ſilk, eſcape through the inciſions. On the contrary a ſtream of air applied to the other ſide will preſs the ſilk upon the plate, and thus cloſe the holes, ſo that it will be impoſſible for it to paſs through them. This valve opens internally, ſo as to admit the air from without. At B is another valve, on the ſame conſtruction, but opening in a contrary direction, thus permitting the air to eſcape out of the lower part into the tube E F, but preventing its entrance. At C is another valve, opening internally to admit the air from the tube E F; and at D there is a fourth, opening externally, to diſcharge the air from the upper part.

The flexible tube E F, ſcrewed on at the end C B, being introduced into one of the noſtrils, whilſt the mouth and the other noſtril are cloſed by an aſſiſtant, if we ſeparate the two handles L M, which were cloſe together at the introduction of the tube, it is evident, that the air in the lungs will ruſh into the upper part through the valve C, whilſt the external air will fill the lower part through the valve A: the two handles being again brought into contact, the atmoſpheric air will be forced into the lungs through the valve B, and at the ſame time the air in the upper part will be diſcharged at the valve D. Thus by the alternate play of the double bellows, the lungs will be alternately filled and emptied as in reſpiration. In uſing the inſtrument care ſhould be taken not to be too violent; as the more perfectly the natural motion of reſpiration is imitated the better.

To prevent any ſubſtances from without injuring the valves A, D, fig. 1, the rim is made with a ſcrew, B, fig. 3, in order to receive a cap A A, fig. 3, full of ſmall holes. This ſcrew has alſo another uſe. If dephlogiſticated air be preferred, a bladder filled with it, fig. 4, may, by means of the ſcrew A, be faſtened to the valve A, fig. 1; and to prevent waſte, as this air may ſerve ſeveral times, a flexible tube may be faſtened on the valve D, fig. 1. communicating with the bladder by means of the opening *d*, fig. 4: thus it may be employed as often as the operator thinks proper.

There is a handle K to the partition in the middle, in order that, if it be at any time neceſſary to uſe either of the diviſions alone, the other may be confined from acting. *c*, *b*, fig. 5, repreſent the two valves to be applied at the end of the inſtrument C, B, fig. 1: and fig. 6. is a ſection of the end C B, ſhowing the valves in their proper places.

It is proper to add, that the capacity of the inſtrument ſhould be proportioned to the quantity of air received into the lungs in inſpiration, which Dr Goodwyn has aſcertained to be twelve cubical inches or ſomewhat more. Each diviſion of the inſtrument, therefore, ſhould be capable of containing that quantity.

Long-Wort, in botany. See Pulmonaria.

LUNISOLAR year, in chronology, the ſpace of 532 common years; found by multiplying the cycle of the ſun by that of the moon.

LUNULA. See Lune.

LUPERCALIA, feaſts inſtituted in ancient Rome, in honour of the god Pan—The word comes from *Lupercal*, the name of a place under the Palatine mountain, where the ſacrifices were performed.

The Lupercalia were celebrated on the 15th of the kalends of March, that is, on the 15th of February, or, as Ovid obſerves, on the third day after the ides. They are ſuppoſed to have been eſtabliſhed by Evander.

On the morning of this feaſt, the Luperci, or prieſts of Pan, ran naked through the ſtreets of Rome, ſtriking the married women they met on the hands and belly with a thong or ſtrap of goat's leather, which was held an omen promiſing them fecundity and happy deliveries. See Luperci.

This feaſt was aboliſhed in the time of Auguſtus but afterwards reſtored, and continued to the time of the emperor Anaſtaſius.—Baronius ſays it was aboliſhed by the pope in 496.

LUPERCI, a name given to the prieſts of the god Pan. See Lupercalia.

The *luperci* were the moſt ancient order of prieſts in Rome; they were divided into two colleges or companies, the one called *Fabii* and the other *Quintilii*. To theſe Cæſar added a third, which he called *Julii*.

LUPINUS, lupine, in botany: A genus of the decandria order, belonging to the diadelphia claſs of plants; and in the natural method ranking under the 32d order, *Papilionaceæ*. The calyx is bilabiated; there are five oblong and five roundiſh antheræ; the legumen is coriaceous. There are ſeven ſpecies, ſix of them hardy herbaceous flowery, annuals, and one perennial, riſing with upright ſtalks from one to three or four feet high, ornamented with digitate or fingered leaves, and terminated by long whorled ſpikes of papilionaceous flowers, white, blue, yellow, and roſe-coloured. They are all eaſily raiſed from ſeed; and ſucceed in any open borders, where they make a fine variety.

The ſeeds of the white lupine, which have a leguminous taſte accompanied with a diſagreeable bitter one, are ſaid to be anthelmintic, both internally taken, and applied externally. Caſpar Hoffman cautions againſt their internal uſe, and tells us (from one of the Arabian writers) that they have ſometimes occaſioned death. Simon Pauli alſo ſays that he ſaw a boy of eight or ten years of age, after taking a dram of theſe ſeeds in powder, ſeized with exquiſite pains in the abdomen, a difficulty of reſpiration, and almoſt total loſs of voice; and that he was relieved from theſe complaints by a glyſter of milk and ſugar, which brought away a vaſt quantity of worms. But Mr Geoffroy obſerves, very juſtly, that either theſe ſymptoms were owing to the worms, and not to the medicine; or that theſe ſeeds, if they have any noxious quality, loſe it with their bitterneſs in boiling; ſince they were commonly uſed among the Greeks as food, and recommended by Galen as very wholeſome.

LUPULUS, in botany. See Humulus.

LUPUS, in zoology. See Canis.

Lupus-Marinus. See Anarrhichas.

Lupus, in aſtronomy. See there, n° 406.

LURCHER, a kind of hunting dog much like a mongrel gre-hound, with pricked ears, a ſhagged coat, and generally of a yellowiſh white colour: they are very ſwift runners, ſo that if they get between the burrows and the conies they ſeldom miſs; and this is their common practice in hunting: yet they uſe other ſubtilties, as the tumbler does, ſome of them bringing their game and thoſe are the beſt. It is alſo obſervable, that a lurcher will run down a hare at ſtretch.

LURE, in falconry, a device of leather, in the ſhape of two wings, ſtuck with feathers, and baited with a piece of fleſh, to call back a hawk when at conſiderable diſtance.

LURGAN, a poſt and fair town in the county of Armagh and province of Ulſter in Ireland, 67 miles from Dublin. It is a flouriſhing town, agreeably ſituated in the midſt of a much improved country; and the inhabitants are extenſively engaged in the linen manufacture. It ſtands on a gentle eminence, about two miles from Lough Neagh, of which it commands a moſt beautiful and extenſive proſpect. The fairs are three in the year. N. Lat. 54. 35. W. Long. 6. 31.

Lurgan-green, a poſt and fair town of Ireland, in the county of Louth and province of Leinſter, 37 miles from Dublin; a mile beyond which is a handſome ſeat of the earl of Charlemont. It has three fairs in the year.

LURIDÆ, the name of the 28th order in Linnæus's fragments of a natural method. See Botany, p. 462.

LUSATIA, a marquiſate of Germany in upper Saxony; bounded to the eaſt by Sileſia, to the weſt by Miſnia, to the ſouth by Bohemia, and to the north by the marquiſate of Brandenburgh. Till towards the middle of the 15th century, the Upper Luſatia was called the *Mark*, i. e. *the marquiſite or the land of Budiſzin and Gorlitz;* and the Lower only *Luſatia*, which it is ſaid, in the Sclavonic, ſignifies "a woody or marſhy country." The air of the Upper Luſatia, which is hilly or mountainous, is better than that of the Lower, a great part of which is mooriſh and boggy. Both abound in wood, eſpecially the Lower, and turf for fuel. The heath and mountainous tracts are generally barren; but the lower champaign and marſh lands are tolerably fertile, producing paſture, wheat, rye, oats, barley, buck wheat, peaſe, lentils, beans, and millet; together with flax, hops, tobacco, ſome white and red wine, and what is called *manna*. Of ſeveral of theſe articles, however, conſiderable quantities are imported. In this country are found alſo quarries of ſtone, medicinal ſprings, baſtard diamonds, agates, and jaſpers, earths and clays for tobacco-pipes and all ſorts of earthen ware, alum, good iron, ſtone, vitriolic and copper water; nor is it deſtitute of cattle, fiſh, and veniſon. The rivers Spree, the Schwarze or Black Elſter, and the Pulznitz, have their ſources in the Luſatias, which are alſo watered by the Neiſſe and Queis. The ancient inhabitants of this country were the Saxons, who were ſucceded by the Vandals, and theſe by the Sober-Wends, a Sclavonian people. The preſent inhabitants, the deſcendants of the Wends, have an odd dreſs; and the language is ſo inarticulate and guttural, that it hath been ſaid, it might be prononnced without lips, teeth or tongue: but the towns are almoſt wholly peopled by Germans.

In the Upper Luſatia are ſix towns which appear at the land-diets, 16 ſmaller country-towns, and four market towns. In the Lower are four diet-towns, 13 country-towns, and two market ones. Both marquiſates were formerly ſubject either to the kings of Bohemia, the archdukes of Auſtria, or electors of Brandenburgh; but, in 1636, both were abſolutely ceded to the elector of Saxony, in lieu of the 72 tons of gold which he expended in aſſiſting the emperor Ferdinand II. againſt the Bohemians.

Chriſtianity was firſt planted in Luſatia in the ſeventh century, but it was ſeveral centuries after that before Popery was fully eſtabliſhed. In the 11th century many cloiſters were erected in the country; but at the reformation ſuch numbers embraced Lutheraniſm, that it became the predominant religion and ſtill continues, though there are ſtill ſeveral Roman Catholic foundations, churches, market-towns, and villages. The ſect of Hernhuters poſſeſſes a great influence and eſteem here. There are conſiderable manufactures of woollen and linen ſtuffs in the Luſatias, eſpecially the Upper. At Budiſſen, and in the adjacent country, prodigious quantities of ſtockings, ſpatterdaſhes, caps, and gloves are made. The linen manufactures alſo flouriſh here, chiefly in the Upper Luſatia, where all ſorts of linen are made, printed, and dyed. Excluſive of theſe, there are conſiderable manufactures of hats, leather, paper, gunpowder, iron, glaſs, bleached wax, &c. Though the demand and exportation of theſe commmodities, particularly linens and woollens, is not ſo great as formerly, yet it is ſtill conſiderable, and more than overbalances their importations in wool, yarn, ſilk, wines, ſpices, corn, freſh and baked fruits, garden ſtuff, and hops. Diſputes of many years ſtanding have ſubſiſted between the country-artificers and linen-manufacturers on the one ſide, and the diet towns on the other; the latter unjuſtly ſeeking to exclude the former from any ſhare in the linen trade. The natives of this country are ſaid to have quick natural parts, but to be ſordidly penurious. We are told they obſerve the Saxon laws much better than they did the Bohemian. Learning hath been much eſteemed and encouraged in both marquiſates ſince the reformation. The ſchools in the ſix diet-towns of Upper Luſatia, particularly at Gorlitz, Budiſſen, and Zittau, greatly diſtinguiſh themſelves, having handſome ſtipends. In Lower Luſatia alſo are ſome good ſchools, with ſtipends for the maintenance of ſtudents. Printing is ſaid to be much followed, and brought to great perfection in this country.

In Upper Luſatia, the ſtates conſiſt, 1ſt, of thoſe called *ſtate-lords*; 2dly, of the prelates: 3dly, of the gentry and commonalty, under which are comprehended the counts, barons, nobles, and burgeſſes, poſſeſſors of fees and fief-eſtates; and, 5thly, of the repreſentatives of the ſix principal towns. Without the conſent of theſe ſtates no taxes can be impoſed, nor any thing of importance, that regards the public tranſacted. The diets are ordinary or extraordinary. The ordinary meet once in three years, and the extraordinary when ſummoned by the ſovereign upon particular emergencies. As to eccleſiaſtical matters, the dean of Bu-

Budiſſen and his conſiſtory exerciſe all manner of epiſcopal juriſdiction: and, among the Proteſtants, the juriſdicton belongs either to the ſuperior, the upper-office, or the patrons. The revenues ariſing to the ſuperior or ſovereign, from Upper Luſatia, conſiſt partly of the ſubſidies granted by the ſtates, among which, at preſent, are reckoned capitation and eſtate-money; and partly of the beer-tax, exciſe rolls, &c. —Upper Luſatia is divided into two great circles, viz. thoſe of Budiſſen and Gorlitz, which are again divided into leſſer circles.

The land-ſtates of Lower Luſatia conſiſt, like thoſe of the Upper, of prelates, lords, and knights, and the repreſentatives of the ſtate towns, which are Luckau, Gubben-Lubbin, and Kalau. Two land diets are yearly held at Lubben, called *voluntary diets*; but when the ſuperior cauſes the ſtates to be ſummoned together at his diſcretion, and propoſitions to be laid before them, by commiſſaries deputed for that purpoſe, ſuch convention is called a *great land-diet*. The marquiſate is divided into five circles, each of which holds a circle-aſſembly in its circle town. The chief officers appointed either by the ſuperior or the ſtates, are, the preſident of the upper-office, the land-captain and the land-judge. The principal tribunals are, the land-court, and the upper-office, to which lie appeals from the inferior judicatories. There are alſo officers for the ſeveral circles. Spiritual matters belong here to a conſiſtory, erected in 1668. The ordinary taxes are paid into the cheſt of the circle; and from thence conſigned to the general cheſt, of which the upper tax-receiver is ſuperintendant. By him an annual account of the receipts is made out, which is examined and paſſed by the deputies of the ſtates.

LUSITANIA (anc. geog.), one of the diviſions of Spain, extending to the north of the Tagus, quite to the ſea of Cantabria, at leaſt to the Promontorium Celticum. But Auguſtus, by a new regulation, made the Anas its boundary to the ſouth, the Durius to the north; and thus conſtituting only a part of the modern Portugal. *Luſitani* the people, (Diodorus, Stephanus).

LUSTRAL, an epithet given by the ancients to the water uſed in their ceremonies to ſprinkle and purify the people. From them the Romaniſts have borrowed the holy water uſed in their churches.

Lustral Day, (Dies Luſtricus), that whereon the luſtrations were performed for a child, and its name given; which was uſually the ninth day from the birth of a boy, and the eighth from that of a girl. Tho' others performed the ceremony on the laſt day of that week wherein the child was born, and others on the fifth day from its birth.

Over this feaſt-day the goddeſs Nundina was ſuppoſed to preſide; the midwifes, nurſes, and domeſtics. handed the child backwards, and forwards, around a fire burning on the altars of the gods, after which they ſprinkled it with water hence this feaſt had the name of *amphidromia*. The old women mixed ſaliva and duſt with the water. The whole ended with a ſumptuous entertainment. The parents received gifts from their friends on this occaſion. If the child was a male, their door was decked with an olive garland; if a female, with wool, denoting the work about which women were to be employed.

LUSTRATION, in antiquity, ſacrifices or ceremonies by which the ancients purified their cities, fields, armies, or people, defiled by any crime or impurity. Some of theſe luſtrations were public, others private. There were three ſpecies or manners of performing luſtration, *viz.* by fire and ſulphur, by water, and by air; which laſt was done by fanning and agitating the air round the thing to be purified. Some of theſe luſtrations were neceſſary, *i. e.* could not be diſpenſed with: as luſtrations of houſes in time of a plague, or upon the death of any perſon: others again were done out of choice, and at pleaſure. The public luſtrations at Rome were celebrated every fifth year; in which they led a victim thrice round the place to be purified, and in the mean time burnt a great quantity of perfumes. Their country luſtrations, which they called *ambarvalia*, were celebrated before they began to reap their corn: in thoſe of the armies, which they called *armiluſtria*, ſome choſen ſoldiers, crowned with laurel, led the victims, which were a cow, a ſheep, and a bull, thrice round the army ranged in battle-array in the field of Mars, to which deity the victims were afterwards ſacrificed, after pouring out many imprecations upon the enemies of the Romans. The luſtrations of their flocks were performed in this manner: the ſhepherd ſprinkled them with pure water, and thrice ſurrounded his ſheepfold with a compoſition of ſavin, laurel and brimſtone ſet on fire; and after wards ſacrificed to the goddeſs Palas an offering of milk boiled, wine, a cake, and millet. As for private houſes, they were luſtrated with water, a fumigation of laurel, juniper, olive tree, ſavin, and ſuch like; and the victim commonly was a pig. Luſtrations made for particular perſons were commonly called *expiations*; and the victims *piacula*. There was alſo a kind of luſtration uſed for infants, by which they were purified girls the third, and boys the ninth, day after their birth; which ceremony was performed with pure water and ſpittle. See the article Ambarvalia.—In their luſtratory ſacrifices, the Athenians ſacrificed two men, one for the men of their city, and the other for the women. Divers of theſe expiations were auſtere: ſome faſted; others abſtained from all ſenſual pleaſures; and ſome, as the prieſts of Cybele, caſtrated themſelves. The poſtures of the penitents were different according to the different ſacrifices. The prieſts changed their habits according to the ceremony to be performed; white, purple, and black, were the moſt uſual colours. They caſt into the river, or at leaſt out of the city, the animals or other things that had ſerved for a luſtration or ſacrifice of attonement; and thought themſelves threatened with ſome great misfortune when by chance they trod upon them. Part of theſe ceremonies were aboliſhed by the emperor Conſtantine, and his ſucceſſors: the reſt ſubſiſted till the Gothic kings were maſters of Rome; under whom they expired, excepting what the popes thought proper to adopt and bring into the church.

For the luſtration, or rather expiation, of the ancient Jews, ſee Expiation.

LUSTRE, the gloſs or brightneſs appearing on any thing, particularly on manufactures of ſilk, wool, or ſtuff. It is likewiſe uſed to denote the compoſition or manner of giving that gloſs.

The luſtre of ſilks is given them by waſhing in ſoap, then clear water, and dipping them in alum water cold. To give ſtuffs a beautiful luſtre: For every eight pounds of ſtuff allow a quarter of a pound of linſeed; boil it half an hour, and then ſtrain it through a cloth, and let it ſtand till it is turned almoſt to a jelly: afterwards put an ounce and a half of gum to diſſolve 24 hours; then mix the liquor, and put the cloth into this mixture, take it out, dry it in the ſhade, and preſs it. If once doing is not ſufficient, repeat the operation. Curriers gives a luſtre to black leather firſt with juice of barberries, then with gum-arabic, ale, vinegar, and Flanders-glue, boiled together. For coloured leather, they uſe the white of an egg beaten in water. Moroccoes have their luſtre from juice of barberries, and lemon or orange. For hats, the luſtre is frequently given with common water; ſometimes a little black dye is added: the ſame luſtre ſerves for furs, except that for very black furs they ſometimes prepare a luſtre of galls, copperas, Roman alum, ox's marrow, and other ingredients.

LUSTRE, an appellation given to a branched candleſtick, when made of glaſs. See BRANCH and JESSE.

LUSTRINGS. A company was incorporated for making, dreſſing, and luſtrating alamodes and luſtrings in England, who were to have the ſole benefit thereof, by ſtat. 4. and 5. William and Mary. And no foreign ſilks known by the name of *luſtrings* or alamodes are to be imported but at the port of London, &c. Stat. 9. and 10. W. III. c. 43. See SILK.

LUSTRUM, in Roman antiquity, a general muſter and review of all the citizens and their goods, which was performed by the cenſors every fifth year, who afterwards made a ſolemn luſtration. See the article LUSTRATION.

This cuſtom was firſt inſtituted by Servius Tullius, about 180 years after the foundaton of Rome. In courſe of time the luſtra were not celebrated ſo often; for we find the fifth luſtrum celebrated at Rome only in the 574th year of that city.

LUTE, or **LUTING**, among chemiſts, a mixed, tenacious, ductile ſubſtance, which grows ſolid by drying, and, being applied to the juncture of veſſels, ſtops them up ſo as to prevent the air from getting either in or out. See CHEMISTRY-*Index*.

LUTE, is alſo a muſical inſtrument with ſtrings.—The lute conſiſts of four parts, *viz.* the table, the body or belly, which has nine or ten ſides; the neck, which has nine or ten ſtops or diviſions, marked with ſtrings; and the head or croſs, where the ſcrew for raiſing and lowering the ſtrings to a proper pitch of tone are fixed. In the middle of the table there is a roſe or paſſage for the ſound; there is alſo a bridge that the ſtrings are faſtened to, and a piece of ivory between the head and the neck to which the other extremities of the ſtrings are fitted. In playing, the ſtrings are ſtruck with the right hand, and with the left the ſtops are preſſed. The lutes of Bologna are eſteemed the beſt on account of the wood, which is ſaid to have an uncommon diſpoſition for producing a ſweet ſound.

LUTETIA PARISIORUM, (anc. geog.), a town of the Pariſii, in Gallia Celtica, ſituated in an iſland in the Sequana or Seine. It received its name, as ſome ſuppoſe from the quantity of clay, *lutum*, which is in its neighbourhood. J. Cæſar fortified and embelliſhed it, from which circumſtance ſome authors call it *Julii Civitas*. Julian the apoſtate reſided there for ſome time. It is now *Paris*, the capital of France; ſo called from its name *Parys* in the lower age.

LUTHER (Martin), the celebrated author of the Reformation, was a native of Eiſleben in Saxony, and born in 1483. Though his parents were poor, he received a learned education; during the progreſs of which, he gave many indications of uncommon vigour and acuteneſs of genius. As his mind was naturally ſuſceptible of ſerious impreſſions, and tinctured with ſomewhat of that religious melancholy which delights in the ſolitude and devotion of a monaſtic life, he retired into a convent of Auguſtinian friars; where he acquired great reputation, not only for piety, but for love of knowledge and unwearied application to ſtudy. The cauſe of this retirement is ſaid to have been, that he was once ſtruck by lightning, and his companion killed by his ſide by the ſame flaſh. He had been taught the ſcholaſtic philoſophy which was in vogue in thoſe days, and made conſiderable progreſs in it: but happening to find a copy of the bible which lay neglected in the library of his monaſtery, he applied himſelf to the ſtudy of it with ſuch eagerneſs and aſſiduity, as quite aſtoniſhed the monks; and increaſed his reputation for ſanctity ſo much, that he was choſen profeſſor firſt of philoſophy, and afterwards of theology, at Wittemberg on the Elbe, where Frederic elector of Saxony had founded an univerſity.

While Luther continued to enjoy the higheſt reputation for ſanctity and learning, Tetzel, a Dominican friar, came to Wittemberg in order to publiſh indulgences. Luther beheld his ſucceſs with great concern; and having firſt inveighed againſt indulgences from the pulpit, he afterwards publiſhed 95 theſes, containing his ſentiments on that ſubject. Theſe he propoſed, not as points fully eſtabliſhed, but as ſubjects of inquiry and diſputation. He appointed a day on which the learned were invited to impugn them either in perſon or by writing; and to the whole he ſubjoined ſolemn proteſtations of his high reſpect for the apoſtolic ſee, and of his implicit ſubmiſſion to its authority. No opponent appeared at the time prefixed; the theſes ſpread over Germany with aſtoniſhing rapidity, and were read with the greateſt eagerneſs. Though Luther met with no oppoſition for ſome little time after he began to publiſh his new doctrines, it was not long before many zealous champions aroſe to defend thoſe opinions with which the wealth and power of the clergy were ſo ſtrictly connected. Their cauſe, however, was by no means promoted by theſe endeavours; the people began to call in queſtion even the authority of the canon law and of the pope himſelf.—The court of Rome at firſt deſpiſed theſe new doctrines and diſputes; but at laſt the attention of the pope being raiſed by the great ſucceſs of the reformer, and the complaints of his adverſaries, Luther was ſummoned, in the month of July 1518, to appear at Rome, within 60 days, before the auditor of the chamber. One of Luther's adverſaries, named Prierias, who had writtten againſt him, was appointed to examine his doctrines, and to decide concerning them. The pope wrote at the ſame time to the elector of Saxony, beſeeching him not to protect a man whoſe heretical and profane tenets were ſo ſhocking to pious ears; and enjoined the provincial of the Auguſtinians to check by this authority the raſhneſs of an arrogant monk, which brought diſgrace upon their order, and gave offence and diſturbance to the whole church.

From theſe letters, and the appointment of his open enemy Prierias to be his judge, Luther eaſily ſaw what ſentence he might expect at Rome; and therefore diſcovered the utmoſt ſolicitude to have his cauſe tried in Germany, and before a leſs ſuſpected tribunal. He wrote a ſubmiſſive letter to the pope, in which he promiſed an unreſerved obedience to his will, for as yet he entertained no doubt of the divine original of the pope's authority; and by the interceſſion of the other profeſſors, Cajetan the pope's legate in Germany was appointed to hear and determine the cauſe. Luther appeared before him without heſitation; but Cajetan thought it below his dignity to diſpute the point with a perſon ſo much his inferior in rank: and therefore required him, by virtue of the apoſtolic powers with which he was clothed, to retract the errors which he had uttered with regard to indulgences and the nature of faith, and to abſtain for the future from the publication of new and dangerous opinions; and at the laſt forbad him to appear in his preſence, unleſs he propoſed to comply with what had been required of him.

This haughty and violent manner of proceeding, together with ſome other circumſtances, gave Luther's friends ſuch ſtrong reaſons to ſuſpect that even the imperial ſafe-conduct would not be able to protect him from the legate's power and reſentment, that they prevailed on him ſecretly to withdraw from Augſburg, where he had attended the legate, and to return to his own country. But before his departure, according to a form of which there had been ſome examples, he prepared a ſolemn appeal from the pope, ill-informed at that time concerning his cauſe, to the pope, when he ſhould receive more full intimation with reſpect to it.—Cajetan, enraged at Luther's abrupt retreat, and at the publication of his appeal, wrote to the elector of Saxony, complaining of both; and requiring him as he regarded the peace of the church, or the authority of its head, either to ſend that ſeditious monk a priſoner to Rome, or to baniſh him out of his territories. Frederic had hitherto, from political motives, protected Luther, as thinking he might be of uſe in checking the enormous power of the ſee of Rome; and though all Germany reſounded with his fame, the elector had never yet admitted him into his preſence. But upon this demand made by the cardinal, it became neceſſary to throw off ſomewhat of his former reſerve. He had been at great expence and beſtowed much attention on founding a new univerſity, an object of conſiderable importance to every German prince; and foreſeeing how fatal a blow the removal of Luther would be to its reputation, he not only declined complying with either of the pope's requeſts, but openly diſcovered great concern for Luther's ſafety.

The ſituation of our reformer, in the mean time, became daily more and more alarming. He knew very well what were the motives which induced the elector to afford him protection, and that he could by no means depend on a continuance of his friendſhip. If he ſhould be obliged to quit Saxony, he had no other aſylum, and muſt ſtand expoſed to whatever puniſhment the rage or bigotry of his enemies could inflict; and ſo ready were his adverſaries to condemn him, that he had been declared a heretic at Rome before the expiration of the 60 days allowed him in the citation for making his appearance. Notwithſtanding all this, however, he diſcovered no ſymptoms of timidity or remiſſneſs; but continued to vindicate his own conduct and opinions, and to inveigh againſt thoſe of his adverſaries with more vehemence than ever. Being convinced, therefore, that the pope would ſoon proceed to the moſt violent meaſures againſt him, he appealed to a general council, which he affirmed to be the repreſentative of the Catholic church, and ſuperior in power to the pope, who being a fallible man, might err, as St Peter, the moſt perfect of his predeceſſors, had done.

The court of Rome were equally aſſiduous in the mean time to cruſh the author of theſe new doctrines which gave them ſo much uneaſineſs. A bull was iſſued by the pope, of a date prior to Luther's appeal, in which he magnified the virtues of indulgences, and ſubjected to the heavieſt eccleſiaſtical cenſures all who preſumed to teach a contrary doctrine. Such a clear deciſion of the ſovereign pontiff againſt him might have been very fatal to Luther's cauſe, had not the death of the emperor Maximilian, which happened on January 17. 1519, contributed to give matters a different turn. Both the principles and intereſt of Maximilian had prompted him to ſupport the authority of the ſee of Rome; but, in conſequence of his death, the vicariate of that part of Germany which is governed by the Saxon laws devolved to the elector of Saxony; and, under the ſhelter of his friendly adminiſtration, Luther himſelf enjoyed tranquillity, and his opinions took ſuch root in different places, that they could never afterwards be eradicated. At the ſame time, as the election of an emperor was a point more intereſting to the pope (Leo X.) than a theological controverſy which he did not underſtand, and of which he could not foreſee the conſequences, he was ſo extremely ſolicitous not to irritate a prince of ſuch conſiderable influence in the electoral college as Frederic, that he diſcovered a great unwillingneſs to pronounce the ſentence of excommunication againſt Luther, which his adverſaries continually demanded with the moſt clamorous importunity.

From the reaſon juſt now given, and Leo's natural averſion to ſevere meaſures, a ſuſpenſion of proceeding againſt Luther took place for 18 months, though perpetual negociations were carried on during this interval in order to bring the matter to an amicable iſſue. The manner in which theſe were conducted having given our reformer many opportunities of obſerving the corruption of the court of Rome, its obſtinacy in adhering to eſtabliſhed errors, and its indifference about truth, however clearly propoſed or ſtrongly proved, he began, in 1520, to utter ſome doubts with regard to the divine original of the papal authority, which he publicly diſputed with Eccius, one of his moſt learned and formidable antagoniſts. The diſpute was indeciſive, both parties claiming the victory; but it muſt have been very mortifying to the partizans of the Romiſh church to hear ſuch an eſſential point of their doctrine publicly attacked.

The Papal authority being once ſuſpected, Luther proceeded to puſh on his inquiries and attacks from one doctrine to another, till at laſt he began to ſhake the firmeſt foundations on which the wealth and power of the church were eſtabliſhed. Leo then began to perceive that there were no hopes of reclaiming ſuch an incorrigible heretic; and therefore prepared to denounce the ſentence of excommunication againſt him. The college of cardinals was often aſſembled, in order to prepare the ſentence with due deliberation; and the able canoniſts were conſulted how it might be expreſſed with unexceptionable formality. At laſt it was iſſued on the 15th of June 1520. Forty-one propoſitions, extracted out of Luther's works, were therein condemned as heretical, ſcandalous, and offenſive to pious ears; all perſons were forbidden to read his writings, upon pain of excommunication; ſuch as had any of them in their cuſtody were commanded to commit them to the flames; he himſelf, if he did not, within 60 days, publicly recant his errors, and burn his books, was pronounced an obſtinate heretic, excommunicated, and delivered to Satan for the deſtruction of the fleſh; and all ſecular princes were required, under pain of incurring the ſame cenſure, to ſeize his perſon, that he might be puniſhed as his crimes deſerved.

Luther was not in the leaſt diſconcerted by this ſentence, which he had for ſome time expected. He renewed his appeal to his general council; declared the pope to be that antichriſt, or man of ſin, whoſe appearance is foretold in the New Teſtament; declaimed againſt his tyranny with greater vehemence than ever; and at laſt, by way of retaliation, having aſſembled all the profeſſors and ſtudents in the univerſity of Wittemberg, with great pomp, and in the preſence of a vaſt multitude of ſpectators, he caſt the volumes of the canon law, together with the bull of excommunication, into the flames. The manner in which this action was juſtified, gave ſtill more offence than the action itſelf. Having collected from the canon law ſome of the moſt extravagant propoſitions with regard to the plenitude and omnipotence of the pope's power, as well as the ſubordination of all ſecular juriſdiction to his authority, he publiſhed theſe with a commentary, pointing out the impiety of ſuch tenets, and their evident tendency to ſubvert all civil government.

On the acceſſion of Charles V. to the empire, Luther found himſelf in a very dangerous ſituation. Charles, in order to ſecure the pope's friendſhip, had determined to treat him with great ſeverity. His eagerneſs to gain this point, rendered him not averſe to gratify the papal legates in Germany, who inſiſted, that, without any delay or formal deliberation, the diet then ſitting at Worms ought to condemn a man whom the pope had already excommunicated as an incorrigible heretic. Such an abrupt manner of proceeding, however, being deemed unprecedented and unjuſt by the members of the diet, they made a point of Luther's appearing in perſon, and declaring whether he adhered or not to thoſe opinions which had drawn upon him the cenſures of the church. Not only the emperor, but all the princes through whoſe territories he had to paſs, granted him a ſafe conduct; and Charles wrote to him at the ſame time, requiring his immediate attendance on the diet, and renewing his promiſes of protection from any injury or violence. Luther did not heſitate one moment about yielding obedience; and ſet out for Worms, attended by the herald who had brought the emperor's letter and ſafe-conduct. While on his journey, many of his friends, whom the fate of Huſs, under ſimilar circumſtances, and notwithſtanding the ſame ſecurity of an imperial ſafe-conduct, filled with ſolicitude, adviſed and intreated him not to ruſh wantonly into the midſt of danger. But Luther, ſuperior to ſuch terrors, ſilenced them with this reply, "I am lawfully called (ſaid he) to appear in that city; and thither will I go in the name of the Lord, though as many devils as there are tiles on the houſes were there combined againſt me.

The reception which he met with at Worms, was ſuch as might have been reckoned a full reward of all his labours, if vanity and the love of applauſe had been the principles by which he was influenced. Greater crowds aſſembled to behold him than had appeared at the emperor's public entry; his apartments were daily filled with princes and perſonages of the higheſt rank; and he was treated with an homage more ſincere, as well as more flattering, than any which pre-eminence in birth or condition can command. At his appearence before the diet, he behaved with great decency, and with equal firmneſs. He readily acknowledged an exceſs of acrimony and vehemence in his controverſial writings; but refuſed to retract his opiniens unleſs he were convinced of their falſehood, or to conſent to their being tried by any other rule than the word of God. When neither threats nor intreaties could prevail on him to depart from this reſolution, ſome of the eccleſiaſtics propoſed to imitate the example of the council of Conſtance, and, by puniſhing the author of this peſtilent hereſy, who was now in their power, to deliver the church at once from ſuch an evil. But the members of the diet refuſing to expoſe the German integrity to freſh reproach by a ſecond violation of public faith, and Charles being no leſs unwilling to bring a ſtain upon the beginning of his adminiſtration by ſuch an ignominious action, Luther was permitted to depart in ſafety. A few days after he left the city, a ſevere edict was publiſhed in the emperor's name and by authority of the diet, depriving him, as an obſtinate and excommunicated criminal, of all the privileges which he enjoyed as a ſubject of the empire, forbidding any prince to harbour or protect him, and requiring all to ſeize his perſon as ſoon as the term ſpecified in his protection ſhould be expired.

But this rigorous decree had no conſiderable effect; the execution of it being prevented partly by the multiplicity of occupations which the commotions in Spain, together with the wars in Italy and the Low Countries, created to the emperor; and partly by a prudent precaution employed by the elector of Saxony, Luther's faithful patron. As Luther, on his return from Worms, was paſſing near Altenſtrain in Thuringia, a number of horſemen in maſks ruſhed ſuddenly out of a wood, where the elector had appointed them to lie in wait for him, and, ſurrounding his company, carried him, after diſmiſſing all his attendants, to Wortburg, a ſtrong caſtle not far diſtant. There the elector ordered him to be ſupplied with every thing neceſſary or agreeable; but the place of his retreat was carefully concealed, until the fury of the preſent ſtorm againſt him began to abate, upon a change in the political ſyſtem of Europe. In this ſolitude, where he remained nine months, and which he frequently called his *Patmos*, after the name of that iſland to which the apoſtle John was baniſhed, he exerted his uſual vigour and induſtry in defence of his doctrines, or in confutation of his adverſaries, publiſhing ſeveral treatiſes, which revived the ſpirit of his followers, aſtoniſhed to a great degree and diſheartened at the ſudden diſappearance of their leader.

Luther, weary at length of his retirement, appeared publicly again at Wittemberg, upon the 6th of March 1522. He appeared indeed without the elector's leave; but immediately wrote him a letter, to prevent his taking it ill. The edict of Charles V. as ſevere as it was, had given little or no check to Luther's doctrine: for the emperor was no ſooner gone into Flanders, than his edict was neglected and deſpiſed, and the doctrine ſeemed to ſpread even faſter than before. Caroloſtadius, in Luther's abſence, had puſhed things on faſter than his leader; and had attempted to aboliſh the uſe of maſs, to remove images out of the churches, to ſet aſide auricular confeſſion, invocation of ſaints, the abſtaining from meats; had allowed the monks to leave their monaſteries, to neglect their vows, and to marry; in ſhort, had quite changed the doctrine and diſcipline of the church at Wittemburg: all which, though not againſt Luther's ſentiments, was yet blamed by him, as being raſhly and unſeaſonably done. Lutheraniſm was ſtill confined to Germany; it was not got to France; and Henry VIII. of England made the moſt rigorous acts to hinder it from invading his realm. Nay, he did ſomething more: to ſhow his zeal for religion and the holy ſee, and perhaps his ſkill in theological learning, he wrote a treatiſe *Of the ſeven ſacraments*, againſt Luther's book *Of the Captivity of Babylon*; which he preſented to Leo X. in October 1521. The pope received it very favourably; and was ſo well pleaſed with the king of England, that he complimented him with the title of *Defender of the faith*. Luther, however, paid no regard to his kingſhip; but anſwered him with great ſharpneſs, treating both his perſon and performance in the moſt contemptuous manner. Henry complained of Luther's rude uſage of him to the princes of Saxony: and Fiſher, biſhop of Rocheſter, replied to his anſwer, in behalf of Henry's treatiſe: but neither the King's complaint, nor the biſhop's reply, was attended with any viſible effects.

Luther, though he had put a ſtop to the violent proceedings of Caroloſtadius, now made open war with the pope and biſhops; and, that he might make the people deſpiſe their authority as much as poſſible, he wrote one book againſt the pope's bull, and another againſt the order falſely called the *order of biſhops*. The ſame year, 1522, he wrote a letter, dated July the 29th, to the aſſembly of the ſtates of Bohemia; in which he aſſured them that he was labouring to eſtabliſh their doctrine in Germany, and exhorted them not to return to the communion of the church of Rome; and he publiſhed alſo, this year, a tranſlation of the New Teſtament in the German tongue, which was afterwards corrected by himſelf and Melancthon. This tranſlation having been printed ſeveral times, and being in every body's hands, Ferdinand archduke of Auſtria, the emperor's brother, made a very ſevere edict to hinder the farther publication of it; and forbad all the ſubjects of his imperial majeſty to have any copies of it, or of Luther's other books. Some other princes followed his example; and Luther was ſo angry at it, that he wrote a treatiſe, *Of the ſecular power*, in which he accuſes them of tyranny and impiety. The diet of the empire was held at Nurenburg, at the end of the year; to which Hadrian VI. ſent his brief, dated November the 25th: for Leo X. died upon the 2d of December 1521, and Hadrian had been elected pope upon the 9th of January following. In his brief, among other things, he obſerves to the diet, how he had heard with grief, that Martin Luther, after the ſentence of Leo X. which was ordered to be executed by the edict of Worms, continued to teach the ſame errors, and daily to publiſh books full of hereſies: that it appeared ſtrange to him, that ſo large and ſo religious a nation could be ſeduced by a wretched apoſtate friar: that nothing, however, could be more pernicious to Chriſtendom: and that therefore he exhorts them to uſe their utmoſt endeavours to make Luther, and the authors of theſe tumults, return to their duty; or, if they refuſe and continue obſtinate, to proceed againſt them according to the laws of the empire, and the ſeverity of the laſt edict.

The reſolution of this diet was publiſhed in the form of an edict, upon the 6th of March 1523; but it had no effect in checking the Lutherans, who ſtill went on in the ſame triumphant manner. This year Luther wrote a great many pieces: among the reſt, one upon the dignity and office of the ſupreme magiſtrate; which Frederic elector of Saxony is ſaid to have been highly pleaſed with. He ſent, about the ſame time, a writing in the German language to the Waldenſes, or Pickards, in Bohemia and Moravia, who had applied to him "about worſhipping the body of Chriſt in the euchariſt." He wrote alſo another book, which he dedicated to the ſenate and people of Prague, "about the inſtitution of miniſters of the church." He drew up a form of ſaying maſs. He wrote a piece, entitled, *An example of popiſh doctrine and divinity*; which Dupins calls *a ſatire againſt nuns and thoſe who profeſs a monaſtic life*. He wrote alſo againſt the vows of virginity, in his preface to his commentary on 1 Cor. viii. And his exhortations here were, it ſeems, followed with effects: for ſoon after, nine nuns, among whom was Catherine de Bore, eloped from the nunnery at Nimptſchen, and were brought by the aſſiſtance of Leonard Coppen, a burgeſs of Torgau, to Wittemberg. Whatever offence this proceeding might give to the Papiſts, it was highly extolled by Luther; who, in a book writtten in the German language, compares the deliverance of theſe nuns from the ſlavery of a monaſtic life, to that of the ſouls which Jeſus Chriſt has delivered by his death. This year Luther had occaſion to canonize two of his followers, who, as Melchior Adam relates, were burnt at Bruſſels in the beginning of July, and were the firſt who ſuffered martyrdom for his doctrine. He wrote alſo a conſolatory epiſtle to three noble ladies at Miſnia, who were baniſhed from the duke of Saxony's court at Friburg, for reading his books.

In the beginning of the year 1524, Clement VII.

ſent a legate into Germany to the diet, which was to be held at Nurenburg. Hadrian VI. died in October 1523, and was ſucceeded by Clement upon the 19th of November. A little before his death he canonized Benno, who was biſhop of Meiſſen in the time of Gregory VII. and one of the moſt zealous defenders of the holy ſee. Luther, imagining that this was done directly to oppoſe him, drew up a piece with this title, *Againſt the New Idol and Old Devil ſet up at Meiſſen;* in which he treats the memory of Gregory with great freedom, and does not ſpare even Hadrian. Clement VII.'s legate repreſented to the diet of Nurenburg the neceſſity of enforcing the execution of the edict of Worms, which had been ſtrangely neglected by the princes of the empire: but, notwithſtanding the legate's ſolicitations, which were very preſſing, the decrees of that diet were thought ſo ineffectual, that they were condemned at Rome, and rejected by the emperor. It was in this year that the diſpute between Luther and Eraſmus, about free-will, began. Eraſmus had been much courted by the Papiſts to write againſt Luther; but he was all along of opinion, that writing would not be found an effectual way to end the differences and eſtabliſh the peace of the church. However, tired out at length with the importunities of the pope and the Catholic princes, and deſirous at the ſame time to clear himſelf from the ſuſpicion of favouring a cauſe which he would not ſeem to favour, he reſolved to write againſt Luther, though, as he tells Melancthon, it was with ſome reluctance, and choſe free-will for the ſubject. His book was intitled, *A Diatriba, or Conference about Free-will;* and was written with much moderation, and without perſonal reflections. He tells Luther in the preface, "That he ought not to take his diſſenting from him in opinion ill, becauſe he had allowed himſelf the liberty of differing from the judgment of popes, councils, univerſities, and doctors of the church." Luther was ſome time before he anſwered Eraſmus's book; but at laſt publiſhed a treatiſe *De Servo Arbitrio*, or *Of the Servitude of Man's Will;* and though Melancthon had promiſed Eraſmus, that Luther ſhould anſwer him with civility and moderation, yet Luther had ſo little regard to Melancthon's promiſe, that he never wrote any thing ſharper. He accuſed Eraſmus of being careleſs about religion, and little ſolicitous what became of it, provided the world continued in peace; and that his notions were rather philoſophical than Chriſtian. Eraſmus immediately replied to Luther, in a piece called *Hyſperaſpiſtes;* in the firſt part of which he anſwers his arguments, and in the ſecond his perſonal reflections.

In October 1524, Luther flung off the monaſtic habit; which, though not premeditated and deſigned, was yet a very proper preparative to a ſtep he took the year after; we mean, his marriage with Catharine de Bore. Catharine de Bore was a gentleman's daughter, who had been a nun, and was taken, as we have obſerved, out of the nunnery of Nimptſchen, in the year 1523. Luther had a deſign, as Melchior Adam relates, to marry her to Glacius, a miniſter of Ortamunden: but ſhe did not like Glacius; and ſo Luther married her himſelf upon the 13th of June 1525. This conduct of his was blamed not only by the Catholics, but, as Melancthon ſays, by thoſe of his own party. He was even for ſome time aſhamed of it himſelf; and owns, that his marriage had made him ſo deſpicable, that he hoped his humiliation would rejoice the angels, and vex the devils. Melancthon found him ſo afflicted with what he had done, that he wrote ſome letters of conſolation to him. It was not ſo much the marriage, as the circumſtances of the time, and the precipitation with which it was done, that occaſioned the cenſures paſſed upon Luther. He married all of a ſudden, and at a time when Germany was groaning under the miſeries of a war which was ſaid at leaſt to be owing to Lutheraniſm. Then, again, it was thought an indecent thing in a man of 42 years of age, who was then, as he pretended, reſtoring the Goſpel, and reforming mankind, to involve himſelf in marriage with a woman of 26, either through incontinence, or any account whatever. But Luther, as ſoon as he had recovered himſelf a little from this abaſhment, aſſumed his former air of intrepidity, and boldly ſupported what he had done with reaſons. "I took a wife (ſays he) in obedience to my father's commands; and haſtened the conſummation, in order to prevent impediments, and ſtop the tongues of ſlanderers." It appears from his own confeſſion, that this reformer was very fond of Mrs de Bore, and uſed to call her *his Catharine;* which made profane people think and ſay wicked things of him: "And therefore (ſays he) I married of a ſudden, not only that I might not be obliged to hear the clamours which I knew would be raiſed againſt me, but to ſtop the mouths of thoſe who reproached me with Catharine de Bore." Luther alſo gives us to underſtand, that he did it partly as concurring with his grand ſcheme of oppoſing the Catholics.

Luther, notwithſtanding, was not himſelf altogether ſatisfied with theſe reaſons. He did not think the ſtep he had taken could be ſufficiently juſtified upon the principles of human prudence; and therefore we find him, in other places, endeavouring to account for it from a ſupernatural impulſe. But whether there was any thing divine in it or not, Luther found himſelf extremely happy in his new ſtate, and eſpecially after his wife had brought him a ſon. "My rib Kate (ſays he in the joy of his heart) deſires her compliments to you, and thanks you for the favour of your kind letter. She is very well, through God's mercy. She is obedient and complying with me in all things; and more agreeable, I thank God, than I could have expected; ſo that I would not change my poverty for the wealth of Crœſus." He was heard to ſay (Seckendorf tells us), that he would not exchange his wife for the kingdom of France, nor for the riches of the Venetians; and that for three reaſons: firſt, Becauſe ſhe had been given him by God, at the time when he implored the aſſiſtance of the Holy Ghoſt in finding a good wife; ſecondly, Becauſe, though ſhe was not without faults, yet ſhe had fewer than other women; and, thirdly, Becauſe ſhe religiouſly obſerved the conjugal fidelity ſhe owed him. There went at firſt a report, that Catharine de Bore was brought to bed ſoon after her marriage with Luther; but Eraſmus, who had wrote that news to his friends, acknowledged the falſity of it a little after.

His marriage, however, did not retard his activity and diligence in the work of reformation. He reviſed the Augſburg confeſſion of faith, and apology for the Pro-

Proteſtants, when the Proteſtant religion was firſt eſtabliſhed on a firm baſis. See PROTESTANTS and REFORMATION.

After this, Luther had little elſe to do than to ſit down and contemplate the mighty works he had finiſhed: for that a ſingle monk ſhould be able to give the church ſo rude a ſhock, that there needed but ſuch another entirely to overthrow it, may very well ſeem a mighty work. He did indeed little elſe: for the remainder of his life was ſpent in exhorting princes, ſtates, and univerſities, to confirm the reformation which had been brought about through him; and publiſhing from time to time ſuch writings as might encourage, direct, and aid, them in doing it. The emperor threatened temporal puniſhment with armies, and the pope eternal with bulls and anathemas; but Luther cared for none of their threats. His friend and coadjutor Melancthon was not ſo indifferent; for Melancthon had a great deal of ſoftneſs, moderation, and diffidence in his make, which made him very uneaſy, and even ſorrowful, in the preſent diſorders. Hence we find many of Luther's letters written on purpoſe to ſupport and comfort him under theſe ſeveral diſtreſſes and anxieties.

In the year 1533, Luther wrote a conſolatory epiſtle to the citizens of Oſchatz, who had ſuffered ſome hardſhips for adhering to the Augſburg confeſſion of faith; in which, among other things, he ſays: "The devil is the hoſt, and the world is his inn; ſo that wherever you come, you ſhall be ſure to find this ugly hoſt." He had alſo about this time a terrible controverſy with George duke of Saxony, who had ſuch an averſion to Luther's doctrine, that he obliged his ſubjects to take an oath that they would never embrace it. However, 60 or 70 citizens of Leipſic were found to have deviated a little from the Catholic way in ſome point or other, and they were known previouſly to have conſulted Luther about it; upon which George complained to the elector John, that Luther had not only abuſed his perſon, but alſo preached up rebellion among his ſubjects. The elector ordered Luther to be acquainted with this; and to be told at the ſame time, that if he did not clear himſelf of the charge, he could not poſſibly eſcape puniſhment. But Luther eaſily refuted the accuſation, by proving, that he had been ſo far from ſtirring up his ſubjects againſt him, on the ſcore of religion, that on the contrary he had exhorted them rather to undergo the greateſt hardſhips, and even ſuffer themſelves to be baniſhed.

In the year 1534, the Bible tranſlated by him into German was firſt printed, as the old privilege, dated at Bibliopolis, under the elector's hand, ſhows; and it was publiſhed the year after. He alſo publiſhed this year a book againſt maſſes and the conſecration of prieſts, in which he relates a conference he had with the devil upon thoſe points; for it is remarkable in Luther's whole hiſtory, that he never had any conflicts of any kind within, but the devil was always his antagoniſt. In February 1537, an aſſembly was held at Smalkald about matters of religion, to which Luther and Melancthon were called. At this meeting Luther was ſeized with ſo grievous an illneſs, that there were no hopes of his recovery. He was afflicted with the ſtone, and had a ſtoppage of urine for 11 days. In this terrible condition he would needs undertake to travel, notwithſtanding all that his friends could ſay or do to prevent him: his reſolution, however, was attended with a good effect; for the night after his departure he began to be better. As he was carried along, he made his will, in which he bequeathed his deteſtation of Popery to his friends and brethren; agreeably to what he often uſed to ſay: *Peſtis eram vivus, moriens ero mors tua, papa;* that is, "I was the plague of Popery in my life, and ſhall continue to be ſo in my death."

This year the Pope and the court of Rome, finding it impoſſible to deal with the Proteſtants by force, began to have recourſe to ſtratagem. They affected therefore to think, that though Luther had indeed carried things on with a high hand and to a violent extreme, yet what he had pleaded in defence of theſe meaſures was not entirely without foundation. They talked with a ſeeming ſhow of moderation; and Pius III. who ſucceeded Clement VII. propoſed a reformation firſt among themſelves, and even went ſo far as to fix a place for a council to meet at for that purpoſe. But Luther treated this farce as it deſerved to be treated; unmaſked and detected it immediately; and, to ridicule it the more ſtrongly, cauſed a picture to be drawn, in which was repreſented the pope ſeated on high upon a throne, ſome cardinals about him with foxes tails on, and ſeeming to evacuate upwards and downwards (*ſurſum deorſum repurgare*, as Melchior Adam expreſſes it). This was fixed over-againſt the title-page, to let the readers ſee at once the ſcope and deſign of the book; which was, to expoſe that cunning and artifice with which thoſe ſubtile politicians affected to cleanſe and purify themſelves from their errors and ſuperſtitions. Luther publiſhed about the ſame time A Confutation of the pretended Grant of Conſtantine to Sylveſter Biſhop of Rome; and alſo ſome letters of John Huſs, written from his priſon at Conſtance to the Bohemians.

In this manner was Luther employed till his death, which happened in the year 1546. That year, accompanied by Melancthon, he paid a viſit to his own country, which he had not ſeen for many years, and returned again in ſafety. But ſoon after he was called thither again by the earls of Mansfeldt, to compoſe ſome differences which had ariſen about their boundaries. Luther had not been uſed to ſuch matters; but becauſe he was born at Iſleben, a town in the territory of Mansfeldt, he was willing to do his country what ſervice he could, even in this way. Preaching his laſt ſermon therefore at Wittemberg, upon the 17th of January, he ſet off on the 23d; and at Hall in Saxony lodged with Juſtus Jonas, with whom he ſtaid three days, becauſe the waters were out. Upon the 28th, he paſſed over the river with his three ſons and Dr Jonas; and being in ſome danger, he ſaid to the Doctor, "Do not you think it would rejoice the devil exceedingly, if I and you, and my three ſons, ſhould be drowned?" When he entered the territories of the earls of Mansfeldt, he was received by 100 horſemen or more, and conducted in a very honourable manner; but was at the ſame time ſo very ill, that it was feared he would die. He ſaid, that theſe fits of ſickneſs often came upon him when he had any great buſineſs to undertake: of this, however, he did not recover; but died upon the 18th of February, in the 63d year of his age. A little before he expired, he admoniſhed thoſe that were about him to pray to God for the propagation of the Goſpel; "becauſe (ſaid he) the council of Trent, which had ſat once or twice, and the pope, would deviſe ſtrange things againſt it." Soon after, his body was put into a leaden coffin, and carried with funeral pomp to the church at Ieſlben, when Dr Jonas preached a ſermon upon the occaſion. The earls of Mansfeldt deſired that his body ſhould be interred in their territories; but the elector of Saxony inſiſted upon his being brought back to Wittemberg; which was accordingly done: and there he was buried with the greateſt pomp that perhaps ever happened to any private man. Princes, earls, nobles, and ſtudents without number, attended the proceſſion; and Melancthon made his funeral oration.

A thouſand lies were invented by the Papiſts about Luther's death. Some ſaid that he died ſuddenly; others, that he killed himſelf; others, that the devil ſtrangled him; others, that his corpſe ſtunk ſo abominably, that they were forced to leave it in the way, as it was carried to be interred. Nay, lies were invented about his death, even while he was yet alive. Luther, however, to give the moſt effectual refutation of this account of his death, put forth an advertiſement of his being alive; and, to be even with the Papiſts for the malice they had ſhown in this lie, wrote a book at the ſame time to prove, that "the papacy was founded by the devil."

Luther's works were collected after his death, and printed at Wittemberg in 7 vols. folio. Catharine de Bore ſurvived her huſband a few years; and continued the firſt year of her widowhood at Wittemberg, though Luther had adviſed her to ſeek another place of reſidence. She went from thence in the year 1547, when the town was ſurrendered to the emperor Charles V. Before her departure, ſhe had received a preſent of 50 crowns from Chriſtian III. king of Denmark; and the elector of Saxony, and the counts of Mansfeldt, gave her good tokens of their liberality. With theſe additions, to what Luther had left her, ſhe had wherewithal to maintain herſelf and her family handſomely. She returned to Wittemberg, when the town was reſtored to the elector; where ſhe lived in a very devout and pious manner, till the plague obliged her to leave it in the year 1552. She ſold what ſhe had at Wittemberg; and retired to Torgau, with a reſolution to end her life there. An unfortunate miſchance befel her in her journey thither, which proved fatal to her. The horſes growing unruly, and attempting to run away, ſhe leaped out of the vehicle ſhe was conveyed in; and, by leaping, got a fall, of which ſhe died about a quarter of a year after, at Torgau, upon the 20th of December 1552. She was buried there in the great church, where her tomb and epitaph are ſtill to be ſeen; and the univerſity of Wittemberg, which was then at Torgau becauſe the plague raged at Wittemberg, made a public programma concerning the funeral pomp.

LUTHERANISM, the ſentiments of Martin Luther with regard to religion. See Luther.

Lutheraniſm has undergone ſome alterations ſince the time of its founder.—Luther rejected the epiſtle of St James as inconſiſtent with the doctrine of St Paul, in relation to juſtification: he alſo ſet aſide the Apocalypſe: both which are now received as canonical in the Lutheran church.

Luther reduced the number of ſacraments to two *viz.* baptiſm, and the euchariſt; but he believed the impanation, or conſubſtantiation, that is, that the matter of the bread and wine remain with the body and blood of Chriſt; and it is in this article that the main difference between the Lutheran and Engliſh churches conſiſts.

Luther maintained the maſs to be no ſacrifice; exploded the adoration of the hoſt, auricular confeſſion, meritorious works, indulgences, purgatory, the worſhip of images, &c. which had been introduced in the corrupt times of the Romiſh church. He alſo oppoſed the doctrine of free-will, maintained predeſtination, and aſſerted our juſtification to be ſolely by the imputation of the merits and ſatisfaction of Chriſt. He alſo oppoſed the faſtings in the Romiſh church, monaſtical vows, the celibate of the clergy, &c.

LUTHERANS, the Chriſtians who follow the opinions of Martin Luther, one of the principal reformers of the church in the 16th century. See Luther.

The Lutherans, of all proteſtants, are thoſe who differ leaſt from the Romiſh church; as they affirm that the body and blood of Chriſt are materially preſent in the ſacrament of the Lord's ſupper, though in an incomprehenſible manner; and likewiſe repreſent ſome religious rites and inſtitutions, as the uſe of images in churches, the diſtinguiſhing veſtments of the clergy, the private confeſſion of ſins, the uſe of wafers in the adminiſtration of the Lord's ſupper, the form of exorciſm in the celebration of baptiſm, and other ceremonies of the like nature, as tolerable, and ſome of them as uſeful. The Lutherans maintain, with regard to the divine decrees, that they reſpect the ſalvation or miſery of men, in conſequence of a previous knowledge of their ſentiments and characters, and not as free and unconditional, and as founded on the mere will of God. Towards the cloſe of the laſt century, the Lutherans began to entertain a greater liberality of ſentiment than they had before adopted; though in many places they perſevered longer in ſevere and deſpotic principles than other Proteſtant churches. Their public teachers now enjoy an unbounded liberty of diſſenting from the deciſions of thoſe ſymbols or creeds which were once deemed almoſt infallible rules of faith and practice, and of declaring their diſſent in the manner they judge the moſt expedient. Moſheim attributes this change in their ſentiments to the maxim which they generally adopt, that Chriſtians were accountable to God alone for their religious opinions; and that no individual could be juſtly puniſhed by the magiſtrate for his erroneous opinions, while he conducted himſelf like a virtuous and obedient ſubject, and made no attempts to diſturb the peace and order of civil ſociety.

LUTHERN, in architecture, a kind of window over the cornice, in the roof of a building; ſtanding perpendicularly over the naked part of a wall, and ſerving to illuminate the upper ſtory.

Lutherns are of various forms; as ſquare ſemicircular, round, called *bull's eyes*, *flat arches*, &c.

LUTRA, in zoology. See Mustela.

LUTTI (Benedito), an eminent painter, born at Flo-

Florence in 1666. He was the diſciple of Antonio-Dominico Gabiani, and his merit was judged equal to that of his maſter: he painted few beſide eaſel pieces; and his works were much valued and ſought for in England, France, and Germany. The emperor knighted him; and the elector of Mentz, together with his patent of knighthood, ſent him a croſs ſet with diamonds. Lutti was never ſatisfied in finiſhing his pictures; yet though he often retouched them, they never appeared laboured. He died in 1724.

LUTZEN, a town of Upper Saxony in Germany; famous for a battle fought here in 1632, when Guſtavus Adolphus king of Sweden was killed. It is ſituated on the river Elſter, in E. Long. 12. 37. N. Lat. 51. 20.

LUXATION, is when any bone is moved out of its place or articulation, ſo as to impede or deſtroy its proper office or motion. See SURGERY.

LUXEMBURG, a city of the Auſtrian Netherlands, and capital of a duchy of the ſame name. It is ſeated partly on a hill, and partly on a plain: but is very ſtrong both by art and nature. It is but indifferently built, though there are ſome good ſtone houſes in it. There is nothing very remarkable among the ſtructures but the Jeſuits church; which is a handſome edifice, after the modern taſte. It was taken by Louis XIV. in 1684: who ſo augmented the fortifications, that it is now one of the ſtrongeſt towns in Europe. It was ceded to Spain by the treaty of Ryſwick; but the French took it again in 1701, and gave it up to the houſe of Auſtria by the treaty of Utrecht. It is 25 miles ſouth-weſt of Treves, and 100 weſt of Mentz. E. Long. 6. 10. N. Lat. 49. 52.

LUXEMBURG (the duchy of), is one of the 17 provinces of the Netherlands. It is bounded on the eaſt by the archbiſhoprick of Treves; on the ſouth, by Lorrain: on the weſt, partly by Champagne, and partly by the biſhoprick of Liege, which likewiſe, with part of Limburg, bounds it on the north. It lies in the foreſt of Ardenne, which is one of the moſt famous in Europe. In ſome places it is covered with mountains and woods, and in general it is fertile in corn and wine; and here are a great number of iron-mines. The principal rivers are, the Moſelle, the Sour, the Ourte, and the Semoy. It belongs partly to the houſe of Auſtria, and partly to the French; and Thionville is the capital of the French part.

LUXEMBURG, (François Henry de Montmorenci), duke of, and marſhal of France, a renowned general in the ſervice of Louis XIV. was born in 1628. He was with the prince of Conde at the battle of Rocroy, in 1648; and in 1668 diſtinguiſhed himſelf at the conqueſt of Franche Compté. In 1672, he commanded in chief the French army in Holland: when he defeated the enemy near Woerden and Bodegrave, and was univerſally admired for the fine retreat he made in 1673. He became marſhal of France in 1675: gained the battle of Flerus in 1690, that of Steenkirk in 1692, and that of Nerwind in 1693. He died at Verſailles in 1695.

LUXURIANS FLOS, "a luxuriant or double flower;" a flower, ſome of whoſe parts are increaſed in number, to the diminution or entire excluſion of others.

The parts that are augmented or multiplied in luxuriant flowers, are the flower-cup, and petals, which Linnæus conſiders as the teguments or covers of the flower; the parts that are diminiſhed, or entirely excluded, are the ſtamina or chives, which the ſame author denominates the male organs of generation.

Luxuriance in flowers is capable of the three following varieties.

1. A flower is ſaid to be MULTIPLIED (*flos mulitplicatus*), when the increaſe of the petals is not ſuch as to exclude all the ſtamina: in this ſenſe, flowers are properly ſaid to be double, triple, or quadruple, according to the number of multiplications of the petals.

2. A flower is ſaid to be FULL (*flos plenus*), when, by the multiplication of the petals, all the ſtamina are excluded. Such are moſt of the double flowers that engage the attention of floriſts.

3. A flower is ſaid to be PROLIFIC (*flos prolifer*), which produces flowers, and ſometimes leaves, from its centre.

For a particular deſcription of each of theſe kinds of luxuriance in flowers, ſee the articles *MULTIPLICATUS Flos*, *PLENUS Flos*, and *PROLIFER Flos*.

Many natural orders of plants do not in any circumſtances produce luxuriant flowers. Of this kind are the maſqued flowers of Tournefort, excepting calve's-ſnout; the rough-leaved, umbelliferous, ſtarry plants, and ſuch as flower at the joints, of Ray: ſome umbelliferous flowers, however, are *prolific*.

The pea-bloom, or butterfly-ſhaped flowers are rarely rendered double; ſome inſtances, however, of luxuriance are obſerved in a ſpecies of ladies-finger, coronilla, and broom.

All luxuriant flowers are vegetable monſters. Such as are perfectly full, by which we mean the greateſt degree of luxuriance, cannot be propagated by ſeeds; becauſe theſe, for want of impregnation, can never ripen. Full flowers therefore are very properly denominated by Linnæus *eunuchs*. This higheſt degree of luxuriance is very common in carnation, lychnis, anemone, ſtock, Indian creſs, roſe, march marigold, ranunculus, violet, pæony, and narciſſus.

Flowers which do not exclude all the ſtamina, perfect their ſeeds. Of this kind are poppy, fennel-flower, campanula, and ſome others.

Some flowers, as thoſe of the water-lily, fig-marigold, and cactus, have many rows or ſeries of petals, without the number of ſtamina being in the leaſt diminiſhed. Such flowers are by no means to be reckoned luxuriant, in the ſlighteſt degree.

Luxuriance in flowers is generally owing to exceſs of nouriſhment..

LUXURY; voluptuouſneſs, or an extravagant indulgence in diet, dreſs, and equipage.

Luxury, among the Romans, prevailed to ſuch a degree, that ſeveral laws were made to ſuppreſs, or at leaſt limit it. The extravagance of the table began about the time of the battle of Actium, and continued in great exceſs till the reign of Galba. Peacocks, cranes of Malta, nightingales, veniſon, wild and tame fowl, were conſidered as delicacies. A profuſion of proviſions was the reigning taſte. Whole wild boars were often ſerved up, and ſometimes they were filled up with various ſmall animals, and birds of different kinds: this diſh they called the *Trojan horſe*, in alluſion to the wooden horſe filled with ſoldiers.

Fowls and game of all ſorts were ſerved up in whole pyramids, piled up in diſhes as broad as moderate tables. Lucullus had a particular name for each apartment; and in whatever room he ordered his ſervants to prepare the entertainments, they knew by the direction the expence to which they were to go. When he ſupped in the Apollo, the expence was fixed at 50,000 *drachmæ*, that is L. 1250. M. Antony provided eight boars for 12 gueſts. Vitellius had a large ſilver platter, ſaid to have coſt a million of *ſeſterces*, called *Minerva's buckler*. In this he blended together the livers of gilt-heads, the brains of pheaſants and peacocks, the tongues of phenicopters, and the milts of lampreys. Caligula ſerved up to his gueſts pearls of great value diſſolved in vinegar; the ſame was done alſo by Clodius the ſon of Æſop the tragedian. Apicius laid aſide 90,000,000 of *ſeſterces*, beſides a mighty revenue, for no other purpoſe but to be ſacrificed to luxury; finding himſelf involved in debt, he looked over his accounts, and though he had the ſum of 10,000,000 of *ſeſterces* ſtill left, he poiſoned himſelf for fear of being ſtarved to death.

The Roman laws to reſtrain luxury were *Lex Orchia, Fannia, Didia, Licinia, Cornelia*, and many others: But all theſe were too little; for as riches increaſed amongſt them, ſo did ſenſuality.

What were the ideas of luxury entertained in England about two centuries ago, may be gathered from the following paſſage of Holinſhed; who, in a diſcourſe prefixed to his Hiſtory, ſpeaking of the increaſe of luxury, ſays, "Neither do I ſpeak this in reproach of any man, God is my judge; but to ſhow, that I do rejoice rather to ſee how God has bleſſed us with his good gifts, and to behold how that in a time wherein all things are grown to the moſt exceſſive prices, we yet do find means to obtain and atchieve ſuch furniture as heretofore was impoſſible. There are old men yet dwelling in the village where I remain, which have noted three things to be marvelouſly altered in England within their ſound remembrance. One is the multitude of chimneys lately erected; whereas in their young days there were not above two or three, if ſo many, in moſt uplandiſh towns of the realm (the religious houſes, and manor places of their lords, always excepted, and peradventure ſome great perſonages), but each made his fire againſt a reredoſs [ſkreen] in the hall where he dreſſed his meat and dined.—The ſecond is the great amendment of lodging; for, ſaid they, our fathers and we ourſelves have lain full oft upon ſtraw pallets covered only with a ſheet, under coverlits made of a dowgſaine or horharriots (to uſe their own terms), and a good log under their head inſtead of a bolſter.—If it were ſo that the father or good man of the houſe had a matraſs, or flock bed and ſheets, a ſack of chaff to reſt his head upon, he thought himſelf to be as well lodged as the lord of the town. So well were they contented, that pillows (ſaid they) were thought meet only for women in childbed; as for ſervants, if they had any ſheet above them, it was well; for ſeldom had they any under their bodies to keep them from pricking ſtraws, that ran oft through the canvas and their hardened hides.—The third thing they tell of, is the exchange of treene [wooden] platters into pewter, and wooden ſpoons into ſilver or tin; for ſo common were all ſorts of treene veſſels in old times, that a man ſhould hardly find four pieces pewter (of which one was peradventure a ſalt) in a good farmer's houſe. Again, in times paſt, men were contented to dwell in houſes builded of ſallow, willow, &c. ſo that the uſe of oak was in a manner dedicated wholly unto churches, religious houſes, princes palaces, navigation, &c. But now willow, &c. are rejected, and nothing but oak any where regarded; and yet ſee the change, for when our houſes were builded of willow, then had we oaken men; but now that our houſes are come to be made of oak, our men are not only become willow, but a great many altogether of ſtraw, which is a ſore alteration. In theſe the courage of the owner was a ſufficient defence to keep the houſe in ſafety; but now the aſſurance of the timber muſt defend the men from robbing. Now have we many chimneys, and yet our tenderlins complain of rheums, catarrhs, and poſes; then had we none but reredoſes, and our heads did never ach. For as the ſmoke in thoſe days were ſuppoſed to be a ſufficient hardening for the timber of the houſe; ſo it was reputed a far better medicine to keep the goodman and his family from the quacks or poſe; wherewith, as then, very few were acquainted. Again, our pewterers in time paſt employed the uſe of pewter only upon diſhes and pots, and a few other trifles for ſervice; whereas now they are grown into ſuch exquiſite cunning, that they can in a manner imitate by infuſion any form or faſhion, of cup, diſh, ſalt, bowl, or goblet, which is made by the goldſmiths craft, though they be ever ſo curious and very artificially forged. In ſome places beyond the ſea, a garniſh of good flat Engliſh pewter (I ſay flat, becauſe diſhes and platters in my time began to be made deep, and like baſons, and are indeed more convenient both for ſauce and keeping the meat warm) is eſteemed ſo precious as the like number of veſſels that are made of fine ſilver."

Particular inſtances of luxury in *eating*, however, might be adduced from an earlier period, ſurpaſſing even the extravagance of the Romans. Thus, in the 10th year of the reign of Edward IV. 1470, George Nevill, brother to the earl of Warwick, at his inſtalment into the archiepiſcopal ſee of York, entertained moſt of the nobility and principal clergy, when his bill of fare was 300 quarters of wheat, 350 tuns of ale, 104 tuns of wine, a pipe of ſpiced wine, 80 fat oxen, ſix wild bulls, 1004 wethers, 300 hogs, 300 calves, 3000 geeſe, 3000 capons, 300 pigs, 100 peacocks, 200 cranes, 200 kids, 2000 chickens, 4000 pigeons, 4000 rabbits, 204 bitterns, 4000 ducks, 200 pheaſants, 500 patridges, 2000 woodcocks, 400 plovers, 100 curlews, 100 quails, 1000 egrets, 200 rees, 400 bucks, does, and roebucks, 1506 hot veniſon paſties, 4000 cold ditto, 1000 diſhes of jelly parted, 4000 diſhes of jelly plain, 4000 cold cuſtards, 2000 hot cuſtards, 300 pikes, 200 breams, eight ſeals, four porpuſſes, 400 tarts. At this feaſt the earl of Warwick was ſteward, the earl of Bedford treaſurer, and lord Haſtings comptroller, with many more noble officers; 1000 ſervitors, 62 cooks, 515 menial apparitors in the kitchen.—But ſuch was the fortune of the man, that after his extreme prodigality he died in the moſt abject but unpitied poverty, *vinctus jacuit in ſumma inopia.*

And as to *dreſs*, luxury in that article ſeems to have attained a great height long before Holinſhed's time: For in the reign of Edward III. we find no fewer that ſeven ſumptuary laws paſſed in one ſeſſion of parliament to reſtrain it. It was enacted, that men ſervants of lords, as alſo of tradeſmen and artiſans, ſhall be content with one meal of fiſh or fleſh every day; and the other meals, daily, ſhall be of milk, cheeſe, butter, and the like. Neither ſhall they uſe any ornaments of gold, ſilk embroidery; nor their wives and daughters any veils above the price of twelvepence. Artiſans and yeomen ſhall not wear cloth above 40s. the whole piece (the fineſt then being about L. 6 per piece), nor the ornaments before named. Nor the women any veils of ſilk, but only thoſe of thread made in England. Gentlemen under the degree of knights, not having L. 100 yearly in land, ſhall not wear any cloth above 4½ marks the whole piece. Neither ſhall they or their females uſe cloth of gold, ſilver, or embroidery, &c. But eſquires having L. 200 *per annum* or upwards of rent, may wear cloths of five marks the whole piece or cloth; and they and their females may alſo wear ſtuff of ſilk, ſilver, ribbons, girdles, or furs. Merchants, citizens, burghers, and artificers of tradeſmen, as well of London as elſewhere, who have goods and chattles of the clear value of L. 500, and their females, may wear as is allowed to gentlemen and eſquires of L. 100 *per annum*. And merchants, citizens, and burgeſſes, worth above L. 1000 in goods and chattels, may (and their females) wear the ſame as gentlemen of L. 200 *per annum*. Knights of 200 marks yearly may wear cloth of ſix marks the cloth, but no higher; but no cloth of gold, nor furred with ermine; but all knights and ladies having above 400 marks yearly, up to L. 1000 *per annum*, may wear as they pleaſe, ermine excepted; and they may wear ornaments of pearl and precious ſtones for their heads only. Clerks having degrees in cathedrals, colleges, &c. may wear as knights and eſquires of the ſame income. Plowmen, carters, ſhepherds, and ſuch like, not having 40s. value in goods or chattels, ſhall wear no ſort of cloth but blanket and ruſſet lawn of 12d. and ſhall wear girdles and belts; and they ſhall only eat and drink ſuitable to their ſtations. And whoſoever uſes other apparel than is preſcribed by the above laws ſhall forfeit the ſame.

Concerning the general utility of luxury to a ſtate, there is much controverſy among the political writers. Baron Monteſquieu lays it down, that luxury is neceſſary in monarchies, as in France; but ruinous to democracies, as in Holland. With regard therefore to Britain, whoſe government is compounded of both ſpecies, it is held to be a dubious queſtion, how far private luxury is a public evil; and, as ſuch, cogniſable by public laws. And indeed their legiſlators have ſeveral times changed their ſentiments as to this point; for formerly there were a number of penal laws exiſting to reſtrain exceſs in apparel, chiefly made in the reigns of Edward III. IV. and Henry VIII. a ſpecimen of which we have inſerted above. But all of them it appeared expedient to repeal at an after period. In fact, although luxury will of neceſſity increaſe according to the influx of wealth, it may not be for the general benefit of commerce to impoſe, as in the above cited laws, an abſolute prohibition of every degree of it: yet, for the good of the public, it may be neceſſary that ſuch as go beyond proper bounds in eating, drinking, and wearing what by no means is ſuitable to their ſtation, ſhould be taxed accordingly, could it be done without including thoſe who have a better title to ſuch indulgence. This is certainly, however, a point which ſhould be maturely weighed before executed; and, in mercantile countries at leaſt, ſuch reſtraints may be found prejudicial, moſt likely impracticable, eſpecially where true liberty is eſtabliſhed. Sir William Temple obſerves, ſpeaking of the trade and riches, and at the ſame time of the *frugality* of the Hollanders, "That ſome of our maxims are not ſo *certain* as *current* in politics: as that encouragement of exceſs and luxury, if employed in the conſumption of *native* commodities, is of advantage to trade. It may be ſo to that which impoveriſhes, but not to that which enriches a country. It is indeed leſs prejudicial, if it lies in *native* than in *foreign* wares; but the humour of *luxury* and expence cannot ſtop at certain bounds; what begins in *native* will proceed in *foreign* commodities; and though the example ariſe among idle perſons, yet the imitation will run into all degrees, even of thoſe men by whoſe induſtry the nation ſubſiſts. And beſides, the more of *our own* we ſpend, the leſs we ſhall have to ſend abroad; and ſo it will come to paſs, that while we drive a vaſt trade, yet, by buying much more than we *ſell*, we ſhall come to be poor at laſt."

LYBIA, or Libya, a name anciently given to all that part of Africa lying between the border of Egypt and the river Triton; and comprehending *Cyrenaica*, *Marmarica*, and the Regio *Syrtica*. See theſe articles.

LYCÆUM, Λυκειον, in antiquity the name of a celebrated ſchool or academy at Athens, where Ariſtotle explained his philoſophy. The place was compoſed of porticoes, and trees planted in the quincunx form, where the philoſophers diſputed walking. Hence *philoſophy of the Lycæum* is uſed to ſignify the philoſophy of Ariſtotle, or the Peripatetic philoſophy. Suidas obſerves, that the Lycæum took its name from its having been originally a temple of Apollo Lycæus; or rather a portico or gallery built by Lycæus ſon of Apollo: but others mention it to have been built by Piſiſtratus or Pericles.

LYCÆUS (anc. geog.), a mountain of Arcadia, ſacred to Jupiter; whence *Jupiter Lycæus* (Pliny). Sacred alſo to Pan (Virgil): and hence *Lycæa*, the rites performed to Pan on this mountain; which Evander carrying with him to Latium, were called *Lupercalia* (Virgil).

LYCAON (fab. hiſt.), the firſt king of Arcadia, ſon of Pelaſgus and Melibœa. He built a town called Lycoſura, on the top of mount Lycæus, in honour of Jupiter. He had many wives, by whom he had a daughter called Calliſto, and 50 ſons. He was ſucceeded on the throne by Nyctimus, the eldeſt of his ſons. He lived about 1820 years before the Chriſtian æra.—Another king of Arcadia celebrated for his cruelties. He was changed into a wolf by Jupiter, becauſe he offered human victims on the altar of the god Pan. Some attribute this metamorphoſis to another cauſe. The ſins of mankind, as they relate, were become ſo enormous, that Jupiter viſited the earth to puniſh wickedneſs and impiety. He came to Arcadia, where he was announced as a god, and the people began to pay proper adoration to his divinity. Lycaon, however, who uſed to ſacrifice all ſtrangers to his wanton cruelty, laughed at the pious prayers of his ſubjects; and to try the divinity of the god, he ſerved up human fleſh at his table. This impiety ſo irritated Jupiter, that he immediately deſtroyed the houſe of Lycaon, and changed him into a wolf.

LYCAONIA, (anc. geog.), a ſmall country of the Hither Aſia, contained between Pamphylia to the ſouth, Cappadocia to the North, Piſidia and Phrygia to the weſt, and Armenia Major to the eaſt. *Lycaones*, the people. This country, though ſituated very near mount Taurus, and part of it on it, yet the Romans reckoned it into Aſia intra Taurum. *Arcadia*, anciently called *Lycaonia*, (Stephanus.)—Alſo an iſland in the Tiber, joined to Rome by a bridge, and to the land by another, namely, the Ceſtius and Fabricius.

LYCHNIS, CAMPION, in botany, including alſo the *Batchelor's Button*, *Catch-Fly*, &c.: A genus of the pentagynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 22d order, *Caryophyllæ*. The calyx is monophyllous, oblong, and ſmooth; there are five unguiculated petals; with the ſegments of the limb almoſt bifid; the capſule quinquelocular.

Species, &c. 1. The Chalcedonica, or Chalcedonian ſcarlet lychnis, hath a fibrated perennial root; upright, ſtraight, hairy, annual ſtalks, riſing three or four feet high; garniſhed with long, ſpear-pointed, cloſe-ſitting leaves, by pairs oppoſite; and the ſtalk crowned by a large, compact, flat bunch of beautiful ſcarlet or flame-coloured flowers, appearing in June and July. Of this there are varieties, with ſingle ſcarlet flowers, with large double ſcarlet flowers of exceeding beauty and elegance, with pale-red flowers, and with white flowers. Of theſe varieties, the double ſcarlet lychnis is ſuperior to all for ſize and elegance; the flowers being large, very double, and collected into a very large bunch, exhibit a charming appearance; the ſingle ſcarlet kind is alſo very pretty; and the others effect an agreeable variety with the ſcarlet kinds. 2. The diœcia, or diœcious lychnis, commonly called *bachelor's-button*, hath fibrated perennial roots; upright ſtalks, branching very diffuſe and irregular, two or three feet high; having oval, acute-pointed, rough leaves, by pairs oppoſite; and all the branches terminated by cluſters of diœcious flowers of different colours and properties in the varieties; flowering in April and May. The varieties, are the common ſingle red-flowered bachelor's button, double red, double white, and ſingle white-flowered. The double varieties are exceedingly ornamental in their bloom; the flowers large, very double, and continue long in blow; the ſingle red ſort grows wild by ditch ſides and other moiſt places in many parts of England; from which the doubles were accidentally obtained by culture in gardens. The flowers are often diœcious, *i. e.* male and female on diſtinct plants. 3. The viſcaria, or viſcous German lychnis, commonly called *catch fly*, hath fibry perennial roots; crowned by a tuft of long graſſy leaves cloſe to the ground; many erect, ſtraight, ſingle ſtalks, riſing a foot and an half or two feet high, exſuding from their upper part a viſcous or clammy matter; garniſhed with long narrow leaves, by pairs oppoſite; and terminated by many reddiſh purple flowers, in cluſters one above another, forming a ſort of long looſe ſpike; all the flowers with entire petals, flowering in May. Of this alſo there are varieties with ſingle red flowers, with double red flowers, and with white flowers. The double variety is conſiderably the moſt eligible for general culture, and is propagated in plenty by parting the roots. All the varieties of this ſpecies emitting a glutinous liquid matter from their ſtalks, flies happening to light thereon ſometimes ſtick and entangle themſelves, whence the plant obtains the name Catch-fly. 4. The flos-cuculi, cuckoo-flower lychnis, commonly called *ragged-robin*, hath fibry perennial roots; upright, branchleſs, channelled ſtalks, riſing near two feet high; garniſhed with long, narrow, ſpear-ſhaped leaves, in pairs oppoſite; and terminated by branchy foot-ſtalks, ſuſtaining many purple, deeply quadrifid flowers; appearing in May. The flowers having each petal deeply quadrifid in a torn or ragged like manner, the plant obtained the cant name of Ragged-robin. There are varieties with ſingle flowers and double flowers. The double ſort is a large, very multiple, fair flower: it is an improved variety of the ſingle, which grows wild in moſt moiſt meadows, and is rarely cultivated; but the double, being very ornamental, merits culture in every garden. All the four ſpecies and reſpective varieties are very hardy; all fibrous rooted, the roots perennial; but are annual in ſtalks, which riſe in ſpring, flower in ſummer, ſucceeded in the ſingles by plenty of ſeed in autumn, by which all the ſingle varieties may be raiſed in abundance, but the doubles only by dividing the roots, and ſome by cuttings of the flower-ſtalks.

LYCIA, a country of Aſia Minor, bounded by the Mediterranean on the ſouth, Caria on the weſt, Pamphylia on the eaſt, and Phrygia on the north. It was anciently called *Milyas* and *Tremile*, from the Milyæ, or Solymi, a people of Crete, who came to ſettle there. The country received the name of *Lycia* from Lycus the ſon of Pandion, who eſtabliſhed himſelf there. The inhabitants have been greatly commended by all the ancients for their ſobriety and juſtice. They were conquered by Crœſus king of Lydia, and afterwards by Cyrus. Though they were ſubject to the power of Perſia, yet they were governed by their own kings, and only paid a yearly tribute to the Perſian monarch. They became part of the Macedonian empire when Alexander came into the eaſt, and afterwards were ceded to the houſe of the Seleucidæ. The country was reduced into a Roman province by the emperor Claudius.

LYCIUM, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 28th order, *Luridæ*. The corolla is tubular, having its throat cloſed up with the beard of the filaments; the berry is bilocular. There are eight ſpecies, natives of various countries.

LYCODONTES, in natural hiſtory, the petrified teeth of the lupus-piſcis or wolf-fiſh, frequently found foſſile. They are of different ſhapes: but the moſt common kind riſe into a ſemiorbicular form, and are hollow within, ſomewhat reſembling an acorn-cup; this hollow is found ſometimes empty, and ſometimes filled with the ſtratum in which it is immerſed. Many of them have an outer circle, of a different colour from the reſt.

LYCOMEDES, (fab. hiſt.), a king of Scyros an iſland in the Ægean ſea. He was ſon of Apollo and Parthenope. He was ſecretly entruſted with the care of young Achilles, whom his mother Thetis had diſguiſed in woman's clothes, to remove him from the Trojan war, where ſhe knew he muſt unavoidably periſh. Lycomedes has rendered himſelf famous for his treachery to Theſeus, who had implored his protection when driven from his throne of Athens by the uſurper Mneſtheus. Lycomedes, as it is reported, either envious of the fame of his illuſtrious gueſts, or bribed by the emiſſaries of Mneſtheus, led Theſeus to an elevated place, on pretence to ſhew him the extent of his dominions, and perfidiouſly threw him down a precipice, where he was killed.

LYCOPERDON, in botany: A genus of the natural order of fungi, belonging to the cryptogamia claſs of plants. The fungus is roundiſh, and full of farinaceous ſeeds. There are 10 ſpecies, of which the following are the moſt remarkable.

1. The tuber, truffles, or ſubterraneous puff-balls, is a native of woods both in Scotland and England. It is a ſubterraneous fungus, growing generally in cluſters three or four inches under ground, without any viſible root. The figure of it is nearly ſpherical, the ſize that of a potato; the exterior coat at firſt white, afterwards black, and ſtudded with pyramidical or polyhedrous tubercles; the internal ſubſtance ſolid and callous, of a dirty white or pale-brown colour, grained like a nutmeg with ſerpentine lines; in which according to Michelli, are imbedded minute oval capſules, containing each from two to four round warted ſeeds. The truffles of Great Britain ſeldom exceed three or four ounces in weight; but in Italy and ſome other parts of the continent, they are ſaid to have been found of the enormous ſize of 8 and even 14 pounds. They are received at their tables, either freſh and roaſted like potatoes, or dried and ſliced into ragouts. They have a volatile and ſomewhat urinous ſmell, and are reputed to be aphrodiſiacal. Dogs are with much pains taught to hunt for them by the ſcent, and to ſcratch up the ground under which they lie.

2. The boviſta, or common puff-ball, is frequent in meadows and paſtures in the autumn. It varies exceedingly in ſize, figure, ſuperficies, and colour.—In general, it conſiſts of a ſack or bag, having a root at its baſe, and the bag compoſed of three membranes, an epidermis, a tough white ſkin, and an interior coat which adheres cloſely to the central pith. The pith in the young plants is of a yellowiſh colour, at firſt firm and ſolid, but ſoon changes into a cellular ſpongy ſubſtance, full of a dark dull-green powder, which diſcharges itſelf through an aperture at the top of the fungus, which aperture is formed of lacerated ſegments, in ſome varieties reflexed. The powder is believed to be the ſeeds, which through a microſcope appear of a ſpherical form, and to be annexed to elaſtic hairs. See *Haller's Hiſt. Helvet. n.* 2172.

Among the numerous varieties of this fungus, the glabrum is moſt remarkable. It is a ſmooth ſeſſile kind, of a nearly ſpherical form, puckered or contracted at the root. This ſometimes grows to an enormous ſize. It has been found in England as big as a man's head; and at Carraria, near Padua in Italy, ſpecimens have been gathered, weighing 25 pounds, and meaſuring two yards in circumference: but its more ordinary ſize is that of a walnut or an apple.

The varieties of this ſpecies have no limits, being frequently found to run into one another; the ſcaly, warty, and echinated coats turning ſmooth as the plants grow old, and the neck of the fungus having no determinate length. The natural colour of the puff-ball is either white, grey, or aſh-coloured: but is ſometimes found yellowiſh, tawny, and browniſh. The internal ſpongy part of it, bound on to wounds, is eſteemed good to ſtop bleedings. Preſſed and dried in an oven, the puff-ball becomes a kind of tinder, the ſmoke of which is ſaid to intoxicate bees. See *Gent. Mag.* July 1766. The Italians fry the great variety, and indeed any of the others when young, and eat them with ſalt and oil, according to the relation of Marſigli.

LYCOPERSICON. See SOLANUM.

LYCOPODIUM, or CLUB-MOSS; a genus of the natural order of muſci, belonging to the cryptogamia claſs of plants. The antheræ are bivalved and ſeſſile; there are no calyptra. There are 24 ſpecies; of which the following are the moſt remarkable.

1. The *clavatum*, or common club-moſs, is common in dry and mountainous places, and in fir foreſts. The ſtalk is proſtrate, branched, and creeping, from a foot to two or three yards long, the radicles woody. The leaves are numerous, narrow, lanceolated, acute, often incurved at the extremity, terminated with a long white hair, and every where ſurround the ſtalk. The peduncles are erect, firm, and naked (except being thinly ſet with lanceolate ſcales), and ariſe from the end of the branches. They are generally two or three inches long and terminated with two cylindrical yellowiſh ſpikes, imbricated with oval-acute ſcales, finely lacerated on the edges, and ending with a hair. In the *ala* or boſom of the ſcale is a kidney-ſhaped capſule, which burſts with elaſticity when ripe, and throws out a light yellow powder, which blown into the flame of a candle, flaſhes with a ſmall exploſion. The Swedes make matts of this moſs to rub their ſhoes upon. In Ruſſia, and ſome other countries, the powder of the capſules is uſed in medicine to heal galls in children, chops in the ſkin, and other ſores. It is alſo uſed to powder over officinal pills, and to make artificial lightning at theatres. The Poles make a decoction of the plant, and, dipping a linen cloth into it, apply it to the heads of perſons afflicted with the diſeaſe called the *plica polonica*, which is ſaid to be cured by this kind of fomentation.

2. The *ſelago*, or fir club-moſs, is common in the Highland mountains of Scotland, and in the Hebrides. The ſtalk at the baſe is ſingle and reclining; but a little higher is divided into upright dichotomous branches, from two to ſix inches high, ſurrounded with eight longitudinal oblique ſeries of lanceolate, ſmooth, rigid, imbricated leaves. Near the ſummits of the branches, in the *alæ* of the leaves, are placed ſingle kidney-ſhaped capſules, conſiſting of two valves, which open horizontally like the ſhells of an oyſter, and

and caſt out a fine yellow powder. Theſe capſules Linnæus ſuppoſes to be *antheræ*, or male parts of fructification. In the *alæ* alſo of many of the leaves, near the tops of the branches, are often found what the ſame great author calls *female flowers*, but which the ingenious Haller eſteems to be only gems or buds of a future plant. They conſiſt, firſt, of four ſtiff, lanceolate, carved, minute leaves, one of the outermoſt longer and larger than the reſt. Theſe are ſuppoſed to correſpond with the *calyx* in regular flowers. Again, at the bottom of this *calyx* are five ſmall pellucid ſubſtances reſembling leaves, viſible only by a microſcope, which are ſuppoſed analogous to piſtils. Theſe, in time, grow up into three large broad leaves, two of the five united together like the hoof of an ox; with a third narrower one annexed at the baſe, and two other minute ones oppoſite to the other three. Theſe five leaves are joined at the baſe; and in autumn, falling from the *calyx*, vegetate, and produce a new plant. See a diſſertation *De ſeminibus muſcorum, Amænit Academ.* II. p. 161. In the iſland of Raaſay, near Sky, in Roſsſhire, and ſome other places, the inhabitants make uſe of this plant inſtead of alum, to fix the colours in dying. The Highlanders alſo ſometimes take an infuſion of it as an emetic and cathartic: but it operates violently; and, unleſs taken in a ſmall doſe, brings on giddineſs and convulſions. Linnæus informs us, that the Swedes uſe a decoction of it to deſtroy lice on ſwine and other animals.

LYCOPOLIS, or LYCON, (anc. geog.) ſo called from the worſhip of wolves. *Lycopolitæ*, the people; *Lycopolites*, the diſtrict. There were two towns of this name, one in the Delta, or lower Egypt, near the Mediterranean; the other in the Thebais, or Higher Egypt, in the northern part, to the weſt of the Nile.

LYCOPHRON, a famous Greek poet and grammarian, born at Colchis in Eubœa, flouriſhed about 304 B. C. and, according to Ovid, was killed by an arrow. He wrote 20 tragedies; but all his works are loſt, except a poem intitled *Caſſandra*, which contains a long train of predictions, which he ſuppoſes to have been made by Caſſandra, Priam's daughter. This poem is extremely obſcure. The beſt edition of it is that of Dr Potter, printed at Oxford in 1697, folio.

LYCOPSIS, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 41ſt order, *Aſperifoliæ*. The corolla has an incurvated tube.

LYCOPUS, in botany: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The corolla is quadrifid, with one of the ſegments emarginated; the ſtamina ſtanding aſunder, with four retuſe ſeeds.

LYCURGIA, a feſtival obſerved by the Spartans, in memory of their lawgiver Lycurgus, whom they honoured with a temple and anniverſarry ſacrifice.

LYMPHÆA, were artificial caves or grottos amongſt the Romans, furniſhed with a great many tubes, canals, and various hydraulic apparatus, thro' which the water guſhed out upon the ſpectators unexpectedly whilſt they were admiring the beautiful arrangement of the ſhell-work in the grotto.

LYCURGUS, the celebrated legiſlator of the Spartans, was the ſon of Eunomes king of Sparta. ——He travelled to Greece, to the iſle of Crete, to Egypt, and even to the Indies, to converſe with the ſages and learned men of thoſe countries, and to learn their manners, their cuſtoms, and their laws. After the death of his brother Polydectes, who was king of Sparta, his widow offered the crown to Lycurgus, promiſing that ſhe would make herſelf miſcarry of the child of which ſhe was pregnant, provided he would marry her; but Lycurgus nobly refuſed theſe advantageous offers, and afterwards contented himſelf with being tutor to his nephew Charillus, and reſtored him to the government when he came of age; but notwithſtanding this regular and generous conduct, he was accuſed of a deſign to uſurp the crown. This calumny obliged him to retire to the iſland of Crete, where he applied himſelf to the ſtudy of the laws and cuſtoms, of nations. At his return to Lacedemon, he reformed the government: and, to prevent the diſorders occaſioned by luxury and the love of riches, he prohibited the uſe of gold and ſilver; placed all the citizens in a ſtate of equality; and introduced the ſtricteſt temperance, the moſt exact diſcipline, and thoſe admirable laws which (a few excepted) have been celebrated by all hiſtorians. It is ſaid, that, to engage the Lacedemonians to obſerve them inviolably, he made them promiſe with an oath not to change any part of them till his return; and that he afterwards went to the iſland of Crete, where he killed himſelf, after having ordered that his aſhes ſhould be thrown into the ſea, for fear leſt if his body ſhould be carried to Sparta the Lacedemonians ſhould think themſelves abſolved from their oath. He flouriſhed about 870 B. C.

LYDD, a town of Kent in England, two miles and a half ſouth-weſt of Romney, of which town and port it is a member, and 71 miles from London. It is a populous town, with a market on Thurſday, and fair on July 24th. It is incorporated by the name of a bailiff, elected July 22d, jurats, and commonalty. In the beach near ſtone-end, is a heap of ſtones, fancied to be the tomb of Criſpin and Criſpianus. And near the ſea is a place called *Holmſtone*, conſiſting of beach and pebble-ſtones, which abounds nevertheleſs with holm trees. Here is a charity ſchool.

LYDGATE (John), called the *Monk of Bury*; not, as Cibber conjectures, becauſe he was a native of that place, for he was born about the year 1380, in the village of Lydgate; but becauſe he was a monk of the Benedictine convent at St Edmond's-Bury. After ſtudying ſome time in the Engliſh univerſities, he travelled to France and Italy; and, having acquired a competent knowledge of the languages of thoſe countries, he returned to London, where he opened a ſchool, in which he inſtructed the ſons of the nobility in polite literature. At what time he retired to the convent of St Edmund's-Bury, does not appear; but he was certainly there in 1415. He was living in 1446, aged about 66; but in what year he died is not known. Lydgate, according to Pits, was an elegant poet, a perſuaſive rhetorician, an expert mathematician, an acute philoſopher, and a tolerable divine. He was a voluminous writer; and, conſidering the age in which he lived, an excellent poet. His language is leſs obſolete, and his verſification much more harmonious. than the language and veſification of Chaucer, who wrote about half a century before him. He wrote, 1. Hiſtory of the Theban war, printed at the end of Chaucer's works, 1561, 1602, 1687. 2. Poemation of good council; at the end of Chaucer's works. 3. The life of Hector; London 1594, fol. printed by Groſs, dedicated to Henry V. 4. Life of the bleſſed Virgin; printed by Caxton. 5. The proverbs of Lydgate upon the fall of princes; printed by Wink. Word. Lond. . . . . 4to. 5. Diſpute of the horſe, the ſheep, and the gooſe; printed in Caxton's Collect. 4to. 6. The temple of braſs; among the works of Chaucer. 7. London lickpenny; *vide* Stowe's Hiſtory, &c. &c. Beſides an incredible number of other poems and tranſlations preſerved in various libraries, and of which the reader will find a catalogue in biſhop Tanner.

LYDIA (anc. geog.), a celebrated kingdom of Aſia Minor.—All the ancient writers tells us, that Lydia was firſt called *Mæonia* or *Meonia*, from Meon king of Phrygia and Lydia; and that it was known under no other denomination till the reign of Atys, when it began to be called *Lydia* from his ſon Lydus. Bochart finding in his learned collection of Phœnician words the verb *luz*, ſignifying "to wind," and obſerving that the country we are ſpeaking of is watered by the Mæander ſo famous for its windings, concludes that it was thence named *Lydia*, or *Ludia*. As to the ancient name of Mæonia, he takes it to be a Greek tranſlation of the Phœnician word *lud;* wherein he agrees in ſome meaſure with Stephanus, who derives the name of Mæonia from Mæon the ancient name of the Mæander. Some take the word *mæonia* to be a tranſlation of a Hebrew word ſignifying "metal," becauſe that country, ſay they, was in former times enriched above any other with mines. Though Lydia and Mæonia are by moſt authors indifferently uſed for one and the ſame country, yet they are ſometimes diſtinguiſhed; that part where mount Tmolus ſtood, watered by the Pactolus, being properly called *Mæonia;* and the other, lying on the coaſt, *Lydia.* This diſtinction is uſed by Homer, Callimachus, Dionyſius, and other ancient writers. In after ages, when the Ionians, who had planted a colony on the coaſt of the Egean Sea; began to make ſome figure, that part was called *Ionia*, and the name of *Lydia* given to the ancient Mæonia.—Lydia, according to Pliny, Ptolemy, and other ancient geogpaphers, was bounded by the Myſia Major on the north, by Caria on the ſouth, by Phrygia Major on the eaſt, and Ionia on the weſt, lying between the 37th and 39th degrees of north latitude. What the ancients ſtyle the kingdom of *Lydia* was not confined within theſe narrow boundaries, but extended from Halys to the Egean ſea. Pliny's deſcription includes Æolia, lying between the Hermus and the Caicus.

As to the origin of the Lydians, Joſephus, and after him all the eccleſiaſtic writers, derive them from Lud Shem's fourth ſon; but this opinion has no other foundation than the ſimilitude of names. Some of the ancients will have the Lydians to be a mixed colony of Phrygians, Myſians, and Carians. Others finding ſome conformity in religion and religious ceremonies between the Egyptians and Tuſcans who were a Lydian colony, conclude them, without any farther evidence, to be originally Egyptians. All we know for certain is, that the Lydians were a very ancient nation, as is manifeſt from their very fables; for Atys, Tantalus, Pelops, Niobe, and Arachne, are all ſaid to have been the children of Lydus. And Zanthus in his *Lydiaca*, quoted by Stephanus, informs us, that the ancient city of Aſcalon, one of the five ſatrapies of the Philiſtines, mentioned in the books of Joſhua and the Judges, was built by one Aſcalus a Lydian, whom Achiamus king of Lydia had appointed to command a body of troops which he ſent, we know not on what occaſion, into Syria. The Heraclidæ, or kings of Lydia, deſcended from Hercules, began to reign before the Trojan war; and had been preceded by a long ſeries of ſovereigns ſprung from Atys, and hence ſtyled *Atyadæ:* a ſtrong proof of the antiquity of that kingdom.

The Lydians began very early to be ruled by kings whoſe government ſeems to have been truly deſpotic and the crown hereditary. We read of three diſtinct races of kings reigning over Lydia, viz. the Atyadæ, the Heraclidæ, and the Mermnadæ.

The *Atyadæ* were ſo called from Atys the ſon of Cotys and grandſon of Manes the firſt Lydian king. But the hiſtory of this family is obſcure and fabulous.

The Atyadæ were ſucceeded by the *Heraclidæ*, or the deſcendants of Hercules. For Hercules being, by the direction of the oracle, ſold as a ſlave to Omphale a queen of Lydia to expiate the murder of Iphitus, had, during his captivity, by one of her ſlaves, a ſon named *Cleolaus*, whoſe grandſon Argon was the firſt of the Heraclidæ that aſcended the throne of Lydia. This race is ſaid to have reigned 505 years, the father ſucceeding the ſon for 22 generations. They began to reign about the time of the Trojan war. The laſt of the family was the unhappy Candaules, who loſt both his life and his kingdom by his imprudence. An event of which we have the following account By Herodotus. Candaules had a wife whom he paſſionately loved, and believed the moſt beautiful of her ſex. He extolled her charms to Gyges his favourite, whom he uſed to intruſt with his moſt important affairs; and the more to convince him of her beauty, reſolved to ſhow her to him quite naked: he accordingly placed him in the porch of her chanber where the queen uſed to undreſs when ſhe went to bed, ordering him to retire after he ſhould have ſeen her, and take all poſſible care not to be obſerved. But notwithſtanding all the caution he could uſe, ſhe plainly diſcovered him going out; and though ſhe did not doubt but it was her huſband's contrivance, yet ſhe paſſed that night in a ſeeming tranquillity, ſuppreſſing her reſentment till next morning, when ſhe ſent for Gyges, and reſolutely told him that he muſt either by his death atone for the criminal action he had been guilty of, or put to death Candaules the contriver of it, and receive both her and the kingdom of Lydia for his reward. Gyges at firſt earneſtly begged of her that ſhe would not drive him to the neceſſity of ſuch a choice. But finding that he could not prevail with her, and that he muſt either kill his maſter or die himſelf, he choſe the former part of the alternative. Being led by the queen to the ſame place where her huſband had poſted him the night before, he ſtabbed the king while he was aſleep, married the queen, and took poſſeſſion of the kingdom, in which he was confirmed by the anſwer of the Delphic oracle. The Lydians having taken up arms to revenge the death of their prince, an agreement was made between them and the followers of Gyges, that if the oracle ſhould declare him to be lawful king of Lydia he ſhould be permitted to reign; if not, he would reſign the crown to the Heraclidæ. The anſwer of the oracle proving favourable to Gyges, he was univerſally acknowledged for lawful king of Lydia. Candaules is ſaid to have purchaſed a picture painted by Bularchas, repreſenting a battle of the Magnetes, for its weight in gold; a circumſtance which ſhows how early the art of painting began to be in requeſt, for Candaules was cotemporary with Romulus.

Gyges having thus poſſeſſed himſelf of the kingdom of Lydia, ſent many rich and valuable preſents to the oracle of Delphos, among others, ſix cups of gold weighing 30 talents, and greatly eſteemed for the workmanſhip. He made war on Miletus and Smyrna, took the city of Colophon, and ſubdued the whole country of Troas. In his reign, and by his permiſſion, the city of Abydus was built by the Mileſians. Plutarch and other writers relate his acceſſion to the crown of Lydia in a quite different manner, and tells us, without making any mention of the queen, that Gyges rebelled againſt Candaules and ſlew him in an engagement. In Gyges began the third race called *Mermnadæ;* who were alſo, properly ſpeaking Heraclidæ, being deſcended from a ſon of Hercules by Omphale. Gyges reigned 38 years, and was ſucceeded by his ſon Ardyes.

This prince carried on the war againſt the Mileſians which his father had begun, and poſſeſſed himſelf of Priene, in thoſe days a ſtrong city. In his reign the Cimerians invaded and over-run all Aſia Minor; but what battles were fought between the Lydians and theſe invaders, and with what ſucceſs, we find no where mentioned. Herodotus only informs us, that in the time of Ardyes they poſſeſſed themſelves of Sardis, the metropolis of Lydia, but could never reduce the caſtle. Ardyes reigned 49 years, and was ſucceeded by his ſon Sadyattes, who reigned 12 years, and warred moſt part of his reign with the Mileſians.

After him came his ſon Alyattes, who for the ſpace of five years continued the war which his father had begun againſt the Mileſians, ravaging their county, and about harveſt time carrying away all their corn yearly, in order to oblige them, for want of proviſions, to ſurrender their city, which he knew he could not reduce any other way, the Mileſians being at that time maſters of the ſea. In the 12th year of this war the Lydians having ſet fire to the corn in the fields, the flames were carried by a violent wind, which happened to blow at that time, to the temple of Minerva at Aſſeſus, and burnt it down to the ground. Not long after, Alyattes falling ſick, ſent to conſult the oracle at Delphos; which refuſed to return any anſwer till ſuch time as the king ſhould rebuild the temple of Minerva at Aſſeſus. Alyattes thus warned, diſpatched ambaſſadors to Miletus, enjoining them to conclude a truce with the Mileſians till the temple ſhould be rebuilt. On the arrival of the ambaſſadors, Thraſybulus, then king of Miletus, commanded all the corn that was at that time in the city to be brought into the market-place, ordering the citizens to banquet in public, and revel as if the city were plentifully ſtored with all manner of proviſions. This ſtratagem Thraſybulus practiſed, to the end that the ambaſſadors ſeeing ſuch quantities of corn, and the people every where diverting themſelves, might acquaint their maſter with their affluence, and divert him from purſuing the war. As Thraſybulus had deſigned, ſo it happened; for Alyattes, who believed the Mileſians greatly diſtreſſed for proviſions, receiving a different account from his ambaſſadors, changed the truce into a laſting peace, and ever afterwards lived in amity and friendſhip with Thraſybulus and the Mileſians. He was ſucceeded, after a reign of 57 years, by his ſon Crœſus, whoſe uninterrupted proſperity, in the firſt years of his reign, far eclipſed the glory of all his predeceſſors. He was the firſt that made war on the Epheſians, whoſe city he beſieged and took notwithſtanding their conſecrating it to Diana, and faſtening the walls by a rope to her temple, which was ſeven ſtadia diſtant from the city. After the reduction of Epheſus, he attacked, under various pretences, the Ionians and Æolians, obliging them, and all the other Greek ſtates of Aſia, to pay him a yearly tribute. Having met with ſuch extraordinary ſucceſs by land, the Lydian prince determined to render his power equally conſpicuous by ſea. For this purpoſe he thought ſeriouſly of equipping a fleet; with which he purpoſed to invade and conquer the Grecian iſlands directly fronting his dominions. But this deſign, which, conſidering the ſlow progreſs in maritime power among the nations moſt diligent to attain it, would probably have failed of ſucceſs, was prevented by the advice of a philoſophical traveller conveyed in ſuch a lively turn of wit, as eaſily changed the reſolution of the king. Bias of Priené in Ionia, ſome ſay Pittacus of Mitylene in the iſle of Leſbos, while he travelled after the Grecian cuſtom, from curioſity and a love of knowledge, was preſented to Crœſus at the Lydian court; and being aſked by that prince what news from Greece; he anſwered with a republican freedom, that the iſlanders had collected powerful ſquadrons of cavalry with an intention of invading Lydia. "May the gods grant (ſaid Crœſus), that the Greeks, who are unacquainted with horſemanſhip, ſhould attack the diſciplined valour of the Lydian cavalry; there would ſoon be an end to the conteſt." "In the ſame manner (replied Bias), as if the Lydians, who are totally unexperienced in naval affairs, ſhould invade the Grecians by ſea." Struck by the acuteneſs of this unexpected obſervation, Crœſus deſiſted from his intended expedition againſt the iſlands, and inſtead of employing new means for extending his conqueſts, determined peaceably to enjoy the laurels which he had won, and to diſplay the grandeur which he had attained. But his happineſs was ſoon after allayed by the death of his favourite ſon Atys, who was unfortunately killed at the chace of a wild boar. For this loſs he continued diſconſolate for two years and in a ſtate of inaction, till the conqueſts of Cyrus, and growing power of the Perſians, rouſed up his martial ſpirit, and diverted his mind to other thoughts. He apprehended that the ſucceſs which attended Cyrus in all his undertakings, might at laſt prove dangerous to himſelf, and therefore reſolved to put a ſtop, if poſſible, to his progreſs. In taking this reſolution, which might probably be attended with the moſt important conſequences, he was deſirous to learn the will of heaven concerning the iſſue of the war. The principal oracles which he conſulted were thoſe of Branchis in Ionia, of Hammon in Libya, and of Delphi in Greece. Among theſe reſpected ſhrines, the oracle of Delphi maintained its aſcendant as the moſt faithful interpreter of fate. Crœſus was fully perſuaded of its veracity; and deſirous generouſly to compenſate for the trouble which he had already given, and ſtill meant to give, the prieſts of Apollo, he ſacrificed 3000 oxen to the god, and adorned his ſhrine with dedications equally valuable for the workmanſhip and for the materials; precious veſſels of ſilver, ewers of iron beautifully inlaid and enamelled; various ornaments of pure gold, particularly a golden lion weighing ten talents, and a female figure three cubits or near five feet high. In return for theſe magnificent preſents, the oracle, in ambiguous language, flattered Crœſus with obtaining an eaſy victory over his enemies, and with enjoying a long life and a proſperous reign. The god at the ſame time enjoined him to contract an alliance with the moſt powerful of the Grecian ſtates.

Elevated with theſe favourable predictions of Apollo, Crœſus prepared to yield a ready obedience to the only condition required on his part for the accompliſhment of his aſpiring purpoſe. Not deeming himſelf ſufficiently acquainted with the affairs of Greece, to know what particular republic was meant by the oracle, he made particular inquiry of thoſe beſt informed concerning the ſtate of Europe; and diſcovered, that among all the members of the Grecian confederacy, the Athenians and Lacedemonians were juſtly intitled to the pre-eminence. In order to learn which of theſe communities deſerved the epithet of *moſt powerful*, it was neceſſary to ſend ambaſſadors into Greece. The Lydians diſpatched with this important commiſſion, ſoon diſcovered that the Athenians, after having been long haraſſed by internal diſſenſions, were actually governed by the tyrant Piſiſtratus. The Spartans, on the other hand, though anciently the worſt regulated of all the Grecian communities, had enjoyed domeſtic peace and foreign proſperity ever ſince they had adopted the wiſe inſtitutions of Lycurgus. After that memorable period, they had repeatedly conquered the warlike Argives, triumphed over the hardy Arcadians; and notwithſtanding the heroic exploits of Ariſtomenes ſubdued and enſlaved their unfortunate rivals of Meſſene. To the Lydian ambaſſadors, therefore, the Spartan republic appeared to be pointed out by the oracle as the community whoſe alliance they were enjoined to ſolicit. Having repaired accordingly to Sparta, they were introduced not only to the king and ſenate, but as the importance of the negociation required, to the general aſſembly of the Lacedemonians, to whom they, in few words, declared the object of their commiſſion: "We are ſent, O Lacedemonians! by Crœſus, king of the Lydians and of many other nations, who being commanded by the oracle of Apollo to ſeek the friendſhip of the moſt powerful people of Greece, now ſummons you, who juſtly merit that epithet, to become his faithful allies, in obedience to the will of the god whoſe authority you acknowledge." The Lacedemonians, pleaſed with the alliance of a warlike king, and ſtill more with the fame of their valour, readily accepted the propoſal. To the ſtrict connection of an offenſive and defenſive league, they joined the more reſpected ties of ſacred hoſpitality. A few years before this tranſaction, they had ſent to purchaſe gold at Sardis for making a ſtatue of Apollo. Crœſus had on that occaſion gratuitouſly ſupplied their want. Remembering this generoſity, they gave the Lydian ambaſſadors at their departure, as a preſent for their maſter, a veſſel of braſs containing 300 amphoras (above 12 hogſheads), and beautifully carved on the outſide with various forms of animals.

Crœſus, having thus happily accompliſhed the deſign recommended by the oracle, was eager to ſet out upon his intended expedition. He had formerly entered into alliance with Amaſis king of Egypt, and Labynetus king of Babylon. He had now obtained the friendſhip of the moſt warlike nation of Europe. The newly-raiſed power of Cyrus and the Perſians ſeemed incapable of reſiſting ſuch a formidable confederacy.

Elevated with theſe flattering ideas of his own invincible greatneſs, Crœſus waited not to attack the Perſian dominions until he had collected the ſtrength of his allies. The ſanguine impetuoſity of his temper unexperienced in adverſity, unfortunately precipitated him into meaſures no leſs ruinous than daring. Attended only by the arms of Lydia, and a numerous band of mercenaries, whom his immenſe wealth enabled him at any time to call into his ſervice, he marched towards the river Halys; and having croſſed with much difficulty that deep and broad ſtream, entered the province of Cappadocia, which formed the weſtern frontier of the Median dominions. That unfortunate country ſoon experienced all the calamities of invaſion. The Pterian plain, the moſt beautiful and the moſt fertile diſtrict of Cappadocia, was laid waſte; the ports of the Euxine, as well as ſeveral inland cities, were plundered; and the inoffenſive inhabitants were either put to the ſword or dragged into captivity. Encouraged by the unreſiſting ſoftneſs of the natives of thoſe parts, Crœſus was eager to puſh forwards; and if Cyrus did not previouſly meet him in the field, he had determined to proceed in triumph to the mountains of Perſia. Againſt this dangerous reſolution he was in vain exhorted by a Lydian named Sandanis; who, when aſked his opinion of the war, declared it with that freedom which the princes of the Eaſt have in every age permitted, amidſt all the pride and caprices of deſpotic power, to men diſtinguiſhed by the gifts of nature or education. "You are preparing, O king, to march againſt a people who lead a laborious and a miſerable life; whoſe daily ſubſiſtence is often denied them, and is always ſcanty and precarious; who drink only water, and who are clothed with the ſkins of wild beaſts. What can the Lydians gain by the conqueſt of Perſia; they who enjoy all the advantages of which the Perſians are deſtitute? For my part I deem it a bleſſing of the gods, that they have not excited the warlike poverty of theſe miſerable barbarians to invade and plunder the luxurious wealth of Lydia." The moderation of this advice was rejected by the fatal preſumption of Crœſus; who confounding the dictates of experienced wiſdom with the mean ſuggeſtions of puſillanimity, diſmiſſed the counſellor with contempt.

Meanwhile, the approach of Cyrus, who was not of a temper to permit his dominions to be ravaged with impunity, afforded the Lydian king an opportunity of bringing the war to more ſpeedy iſſue than by his intended expedition into Perſia. The army of Cyrus gradually augmented on his march, the tributary princes cheerfully contributing with their united ſtrength towards the aſſiſtance of a maſter whoſe valour and generoſity they admired, and who now took arms to protect the ſafety of his ſubjects, as well as to ſupport the grandeur of his throne. Such was the rapidity of his movement, eſpecially after being informed of the deſtructive ravages of the enemy in Cappadocia, that he arrived from the ſhores of the Caſpian to thoſe of the Euxine Sea before the army of Crœſus had provided the neceſſaries for their journey. That prince when appriſed of the neighbourhood of the Perſians, encamped on the Pterian plain; Cyrus likewiſe encamped at no great diſtance; frequent ſkirmiſhes happened between the light troops; and at length a general engagement was fought with equal fury and perſeverance, and only terminated by the darkneſs of night. The loſs on both ſides hindered a renewal of the battle. The numbers, as well as the courage of the Perſians, much exceeded the expectation of Crœſus. As they diſcovered not any intention to haraſs his retreat, he determined to move back towards Sardis, to ſpend the winter in the amuſements of his palace; and after ſummoning his numerous allies to his ſtandard, to take the field early in the ſpring with ſuch increaſe of force as ſeemed ſufficient to overpower the Perſians.

But this deſign was defeated by the careful vigilance of Cyrus. That experienced leader allowed the enemy to retire without moleſtation; carefully informing himſelf of every ſtep which they took, and of every meaſure which they ſeemed determined to purſue. Patiently watching the opportunity of a juſt revenge, he waited until Crœſus had re-entered his capital, and had diſbanded the foreign mercenaries, who compoſed the moſt numerous diviſion of his army. It then ſeemed the proper time for Cyrus to put his Perſians in motion; and ſuch was his celerity, that he brought the firſt news of his own arrival in the plain of Sardis. Crœſus, whoſe firmneſs might well have been ſhaken by the imminence of this unforeſeen danger, was not wanting on the preſent occaſion to the duties which he owed to his fame and the luſtre of the Lydian throne. Though his mercenaries were diſbanded, his own ſubjects, who ſerved him from attachment, who had been long accuſtomed to victory, and who were animated with a high ſenſe of national honour, burned with a deſire of enjoying an opportunity to check the daring inſolence of the invaders. Crœſus indulged and encouraged this generous ardour. The Lydians in that age fought on horſeback, armed with long ſpears; the ſtrength of the Perſians conſiſted in infantry. They were ſo little accuſtomed to the uſe of horſes, that camels were almoſt the only animals which they employed as beaſts of burden. This circumſtance ſuggeſted to a Mede, by name Harpagus, a ſtratagem, which being communicated to Cyrus, was immediately adopted with approbation by that prince. Harpagus, having obſerved that horſes had a ſtrong averſion to the ſhape and ſmell of camels, adviſed the Perſian army to be drawn up in the following order: All the camels which had been employed to carry baggage and proviſions were collected into one body, arranged in a long line fronting the Lydian cavalry. The foot ſoldiers of the Perſians were poſted immediately behind the line, and placed at a due diſtance. The Median horſe (for a few ſquadrons of theſe followed the ſtandard of Cyrus) formed the rear of the army. As the troops on both ſides approached to join battle, the Lydian cavalry, terrified at the unuſual appearance of the camels, mounted with men in arms, were thrown into diſorder, and turning their heads, endeavoured to eſcape from the field. Crœſus, who perceived the confuſion, was ready to deſpair of his fortune; but the Lydians, abandoning their horſes, prepared with uncommon bravery to attack the enemy on foot. Their courage deſerved a better fate; but unaccuſtomed as they were to this mode of fighting, they were received and repelled by the experienced valour of the Perſian infantry, and obliged to take refuge within the fortified ſtrength of Sardis, where they imagined themſelves ſecure. The walls of that city bid defiance to the rude art of attack, as then practiſed by the moſt warlike nations. If the Perſian army ſhould inveſt it, the Lydians were provided with proviſions for ſeveral years; and there was reaſon to expect, that in a few months, and even weeks, they would receive ſuch aſſiſtance from Egypt, Babylonia, and Greece (to which countries they had already ſent ambaſſadors), as would oblige the Perſians to raiſe the ſiege.

The Lydian miniſters diſpatched into Greece met with great ſympathy from the Spartans. That people were particularly obſervant of the faith of treaties; and while they puniſhed their enemies with unexampled ſeverity, they behaved with generous compaſſion towards thoſe whom they had once accepted for allies. They immediately reſolved therefore to ſend him a ſpeedy and effectual relief; and for this purpoſe aſſembled their troops, made ready their veſſels, and prepared every thing neceſſary for the expedition.

The valour of the Spartans might perhaps have upheld the ſinking empire of Lydia; but before their armament could ſet ſail, Crœſus was no longer a ſovereign. Notwithſtanding the ſtrength of Sardis, that city had been taken by ſtorm on the 20th day of the ſiege; the walls having been ſcaled in a quarter which, appearing altogether inacceſſible, was too careleſsly guarded. This was effected by the enterpriſe of Hyreades a Mede, who accidentally obſerved a centinel deſcend part of the rock in order to recover his helmet. Hyreades was a native of the mountainous province of Mardia, and being accuſtomed to clamber over the dangerous precipices of his native country, reſolved to try his activity in paſſing the rock upon which he had diſcovered the Lydian. The deſign was more eaſily accompliſhed than he had reaſon to expect: emulation and ſucceſs encouraged the braveſt of the Perſians to follow his example: theſe were ſupported by greater numbers of their countrymen; the garriſon of Sardis was ſurpriſed; the citadel ſtormed;

the rich capital of Lower Aſia ſubjected to the vengeful rapacity of an indignant victor. Thus ended the ancient kingdom of Lydia, which continued ſubject to the Perſians till they alſo were conquered by the Macedonians.—For the fate of the Lydian monarch, ſee the article Croesus.

LYDIAT (Thomas), a learned Engliſh divine, born in 1572, and educated at Oxford. About the year 1609, he became acquainted with Dr James Uſher, afterwards archbiſhop of Armagh, who carried him to Ireland. He was at Dublin college for about two years, after which he returned to England; and the rectory of Alkrington becoming vacant, he was preſented to it: but at length; being engaged for the debts of a near relation, which for the preſent he was unable to pay, having before ſpent his patrimony in printing ſeveral books, he was ſent to priſon; and was confined at Oxford, in the King's-bench, and elſewhere, till Sir William Boſwell, a generous patron of learned men, Dr Robert Pink, warden of New-college, biſhop Uſher and Dr Laud, diſcharged the debt. In the civil wars, he ſuffered much in his rectory of Alkrington from the parliament-party; was four times pillaged to the value of at leaſt 70l.; and was forced for a quarter of a year together to borrow a ſhirt to ſhift himſelf. He died in 1646. He wrote ſome pieces in Engliſh, and many works in Latin, on chronology and natural hiſtory.

LYDIUS lapis, in the natural hiſtory of the ancients; the name of the ſtone uſed by way of touchſtone for the trial of gold and ſilver, and called by ſome *Heraclius lapis*; both of which names were alſo applied by the ancients to the load-ſtone; and hence has ariſen no ſmall miſunderſtanding of their works. Pliny has obſerved, that both the load-ſtone and touch ſtone were at times called *Lydius and Heraclius lapis*.

The true *lapis Lydius*, or the touchſtone, was anciently found only in the river Tmolus; but was afterwards found in many other places, and is now very common in many of the German rivers. The ancients give us very remarkable and circumſtantial accounts of the uſes they made of it; and it is plain they were able to diſcern the alloys of gold by means of it with very great exactneſs. We at preſent uſe ſeveral different ſtones under this name, and for the ſame purpoſe. In Italy, a green marble called *verdello*, is moſt frequently uſed; and with us, very frequently ſmall pieces of the *baſaltes*, the ſame with that vaſt piece of black marble called the *Giant's Cauſeway* in Ireland. See Basaltes; *Giant's Cauſeway*; Iceland, n° 5; Staffa; and Volcano.

LYGEUM, in botany: a genus of the monogynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the fourth order, *Gramina*. The ſpatha or ſheath is monophyllous; there are a pair of corollæ upon the ſame germen; the nut is bilocular.

LYGII, Ligii, *Lugii*, or *Logiones* (anc. geog.), a people of Germany, to the weſt of the Viſtula, where it forms a bend like a creſcent; *Ligii*, (Dio); *Lugii*, (Strabo); *Logiones*, (Zoſimus). Their name *Lugii*, is conjectured to be derived from their mutually cloſe confederacy or league. The Viſtula was their boundary to the north, eaſt, and ſouth, with mount Aſciburgius to the weſt. Now the whole of that country lies in Poland, on this ſide the Viſtula.

LYING-in-Women. See Midwifery.

Lying-To, or *Lying-By*, the ſituation of a ſhip, when ſhe is retarded in her courſe, by arranging the ſails in ſuch a manner as to counteract each other with nearly an equal effort, and render the ſhip almoſt immoveable, with reſpect to her progreſſive motion, or head-way. A ſhip is uſually brought-to by the main and fore-top ſails, one of which is laid aback, whilſt the other is full; ſo that the latter puſhes the ſhip forward, whilſt the former reſiſts this impulſe by forcing her aſtern. This is particularly practiſed in a general engagement, when the hoſtile fleets are drawn up in two lines of battle oppoſite each other. It is alſo uſed to wait for ſome other ſhip, either approaching or expected; or to avoid purſuing a dangerous courſe, eſpecially in dark or foggy weather, &c.

LYME-regis a ſea-port town of Dorſetſhire in England, 148 miles from London. It lies near the ſea, on the very borders of Devonſhire, in a cavity between two rocky hills, which makes it difficult of acceſs. It is about five furlongs long, and contains about 200 houſes. As it lies on the declivity of a hill, the houſes make a good ſhow, one above another; and ſome of them are built of freeſtone, and covered with blue ſlate. The corporation conſiſts of a mayor (who is juſtice of peace during his mayoralty and the year after, and in the third year both juſtice and coroner), a recorder, 15 capital burgeſſes, and a town-clerk. This place had formerly a very flouriſhing trade to France, Spain, the Straits, Newfoundland, and the Weſt Indies; during which the cuſtoms amounted ſome years to 16,000. But it ſtands on ſuch a high ſteep rock, that the merchants are obliged to load and unload their goods at a place a quarter of a mile off, called the *Cobb*, originally built in the reign of Edward III. which coſts a great ſum to maintain, but forms ſuch a harbour as perhaps is not to be equalled in the world, the ſhips being ſheltered by a high thick ſtone wall, raiſed in the main ſea a good way from the ſhore, broad enough for carriages and warehouſes, and the cuſtom-houſe officers have one upon it. The cellars of the low part of the town near the ſea, are however often overflowed by the ſpring-tides 10 or 12 feet. There are guns planted for defence both of the Cobb and the town, the ſhore here being very proper for batteries. The cuſtom-houſe ſtands on pillars, with the corn-market under it. There is an alms-houſe in church-ſtreet, alſo Preſbyterian and Anabaptiſt meeting-houſes. The town-hall is near Broad-ſtreet. The church ſtands at the eaſt end of the town on a riſing ground. The market here is Friday, and there are two fairs in the year. We read, that, in 774, the Saxon King Kinwulf gave land hereabouts to the church of Sherborn, for the boiling of ſalt there to ſupply its neceſſities. At this place the duke of Monmouth landed in 1685. A few years ago above 2000l. worth of gold and ſilver coin of Char. I. and II. were diſcovered by ſome labourers.

LYMINGTON, a borough town of Hampſhire in England, 97 miles ſouth-weſt of London. It ſtands about a mile from the channel, running between the main land and the Iſle of Wight; and has a harbour for veſſels of conſiderable burden. The tide flows near a mile above the town. It has a market on Saturdays, and two fairs in the year; and ſends two members to parliament.

LYMPH, a fine colourleſs fluid, ſeparated in the body from the maſs of blood, and contained in peculiar veſſels called *lymphatics*. See ANATOMY.

LYMPHATI, was a name given by the Romans to ſuch as were ſeized with madneſs. It is ſuppoſed to be uſed for *Nymphati*, becauſe the ancients imagined that every perſon who had the misfortune to ſee a nymph was inſtantly ſtruck with phrenzy. *Lymphati* may indeed ſignify “madmen,” as derived from *lympha*, “water” over which element the nymphs were thought to preſide; But it appears moſt likely, that diſtracted people were called *Lymphati*, from the circumſtance of madmen's being affected with the *hydrophobia* or dread of water after the bite of a mad dog; for this peculiarity, in caſes of canine madneſs, was not unknown to the Romans,

LYNCEUS, in fabulous hiſtory, one of the 50 ſons of Ægeus, married Hypermneſtra, one of the 50 daughters of Danaus. See HYPERMNESTRA.

LYNCEUS, in fabulous hiſtory, one of the Argonauts, who went with Jaſon in the expedition to obtain the golden fleece. He was of great uſe to the Argonauts, by enabling them to avoid the ſand-banks and rocks they found in their way. The poets ſay, that Lynceus had ſo piercing a ſight, that it could not only penetrate to the bottom of the ſea, but even to hell. Some mythologiſts ſuppoſe, that this fable is taken from Lynceus's ſkill in obſerving the ſtars, and diſcovering the mines of gold and ſilver concealed in the earth.

LYNCURIUM, a ſtone thought to be the ſame with the tourmalin. The name is derived from λυγξ “lynx,” and ȣρον urine.”

LYNCURIUS LAPIS, a ſtone capable of producing muſhrooms.

In the Ephemerides of the Curious we find mention made of a ſtone, ſo called by Dr John George Wolckamerus, who ſaw one in Italy, which never ceaſes to produce in a few days muſhrooms of an excellent flavour by the moſt ſimple and eaſy proceſs imaginable. “It is (ſays he) of the bigneſs of an ox's head, rough and uneven on its ſurface, and on which alſo are perceived ſome clefts and crevices. It is black in ſome parts, and in others of a lighter and greyiſh colour. Internally it is porous, and nearly of the nature of the pumice-ſtone, but much heavier: and it contains a ſmall piece of flint, which is ſo incorporated with it as to appear to have been formed at the ſame time the ſtone itſelf received its form. This gives room to judge, that thoſe ſtones have been produced by a fat and viſcid juice, which has the property of indurating whatever matter it filtrates into. The ſtone here ſpoken of, when it has been lightly covered with earth, and ſprinkled with warm water, produces muſhrooms of an exquiſite flavour which are uſually round, ſometimes oval, and whoſe borders, by their inflexions and different curvities repreſent in ſome meaſure human ears. The principal colour of theſe muſhrooms is ſometimes yellowiſh, and ſometimes of a bright purple: but they are always diſſeminated with different ſpots, of a deep orange colour, or red brown; and when theſe ſpots are recent, and ſtill in full bloom, they produce a very agreeable effect to the ſight. But what appears admirable is, that the part of the ſtalk which remains adhering to the ſtone, when the muſhroom has been ſeparated from it, grows gradually hard and petrifies in time, ſo that it ſeems that this fungites reſtores to the ſtone the nutritive juice it received from it, and that it thus contributes to its increaſe.” John Bapiſt Porta pretends, that this ſtone is found in ſeveral parts of Italy; and that it is not only to be met with at Naples, taken out of mount Veſuvius, but alſo on mount Pantherico, in the principality of Arellino; on mount Garganus, in Apulia; and on the ſummit of ſome other very high mountains. He adds, that the muſhrooms which grow on thoſe ſorts of ſtones, and are uſually called *fungi lyncurii*, have the property of diſſolving and breaking the ſtone of the kidneys and bladder; and that, for this purpoſe, nothing more is required than to dry them in the ſhade, and being reduced to powder, to make the patient, faſting, take a ſufficient quantity of this power in a glaſs of white-wine, which will ſo cleanſe the excretory ducts of the urine, that no ſtones will ever after be collected in them. As to the form of thoſe muſhrooms, their root is ſtony, uneven, divided according to its longitudinal direction, and compoſed of fibres as fine as hairs, interwoven one with another. Their form, on firſt ſhooting out, reſembles a ſmall bladder, ſcarce then larger than the bud of a vine; and if in this ſtate they are ſqueezed between the fingers, an aqueous ſubacid liquor iſſues out. When they are at their full growth, their pedicle is of a finger's length, larger at top than at bottom, and becomes inſenſibly ſlenderer in proportion as it is nearer the earth. Theſe muſhrooms are alſo formed in an umbella, and variegated with an infinity of little ſpecks ſituated very near one another. They are ſmooth and even on the upper part, but underneath leafy like the common muſhrooms. Their taſte is likewiſe very agreeable, and the ſick are not debarred eating of them when they have been dreſſed in a proper manner. Curioſity having prompted ſome naturaliſts and phyſicians to ſubmit theſe ſtones to a chemical analyſis, in order to be more competent judges of the uſes they might be put to in medicine, there firſt came forth, by diſtillation, an inſipid water, and afterwards a ſpirituous liquor. The retort having been heated to a certain point, there aroſe an oil, which had nearly the ſmell and taſte of that of guaiacum; and a very acrid ſalt was extracted from the aſhes.

LYNN-REGIS, a town of Norfolk, in England, diſtant 98 miles from London. It is a handſome, large, well-built place, and ſends two members to parliament. It was a borough by preſcription in 1298. King John, on account of its adherence to him againſt the barons, made it free a borough, with large privileges. He appointed it a provoſt, and gave it a large ſilver cup of 73 ounces doubly gilt and enamelled, and a large ſilver ſword that is carried before the mayor; though this laſt, according to ſome, is Henry VIII.'s ſword, which he gave to the town when it came into his hands by exchange with the biſhop of Norwich; after which it was called king's Lynn, whereas before it was Biſhop's Lynn. Henry III. made it a mayor-town, for its ſerving him againſt the barons.

It has had 15 royal charters; and is governed by a mayor, high-ſteward, under-ſteward, recorder, 12 aldermen, and 18 common-council men. It has two churches, beſides St Nicholas, a chapel of eaſe to St Margaret's, a preſbyterian and a quakers meeting-houſe, with a bridewell or workhouſe, and ſeveral alms-houſes, and a free-ſchool. In September 1741 the ſpires of its two churches were both blown down by a ſtorm of wind; and that of St Margaret's which was 193 feet in height, having beat in the body of the church, it has been ſince rebuilt, towards which king George II. gave L. 1000, and the late earl of Orford, then Sir Robert Walpole, L. 500. This church was formerly an abbey, and afterwards one of the largeſt pariſh-churches in England. The town-houſe, called Trinity-hall, is a noble old fabric; and ſo is the Exchange, which is of free-ſtone, with two orders of columns. St Nicholas's chapel is very ancient, and reckoned one of the faireſt and largeſt of the kind in England. It has a bell-tower of free-ſtone, and an eight-ſquare ſpire over it, both which together are 170 feet from the ground. There is a library in it that was erected by ſubſcription; and there is another at St Margaret's. Here have been formerly ſeveral monaſteries; but the only fabric remaining that belongs to any religious order is the Grey-friars ſteeple, a noted ſea-mark. The ſituation of this town, near the fall of the Ouſe into the ſea, after having received ſeveral other rivers, of which ſome are navigable, gives it an opportunity of extending its trade into eight different counties; by which many conſiderable cities and towns, viz. Peterborough, Ely, Stamford, Bedford, St Ives, Huntingdon, St Neot's, Northampton, Cambridge, St Edmundſbury, and the north part of Bucks, as well as the inland parts of Norfolk and Suffolk, are ſupplied with heavy goods, not only from their own produce, as coals and ſalt from Newcaſtle, but alſo of merchandize imported from abroad, eſpecially wine; of which two articles, viz. coals and wine, this is the greateſt port for importation of any place on all the eaſtern coaſt of England; and thoſe wherein the Lynn merchants deal more largely than any town in England, except London, Briſtol, and Newcaſtle. In return form this, Lynn receives back all the corn which the counties juſt mentioned produce, for exportation; and therefore ſends more of it abroad than any port except Hull. The foreign trade of the merchants here is very conſiderable, eſpecially to Holland, Norway, and the Baltic, and alſo to Spain and Portugal; and formerly they drove a good trade to France, till it was turned off, by treaties on one hand, and by prohibitions, high duties, &c. on the other, to Spain and Portugal. The harbour is ſafe when ſhips are in it, but difficult to enter by reaſon of the many flats and ſhoals in the paſſage; which, however, are well buoyed, and good pilots are always ready. The town conſiſts of about 2400 houſes; and appears to have been very ſtrong, by the ruins of the works demoliſhed in the civil wars. St Ann's platform at the north end mounts 12 great guns, and commands all the ſhips paſſing near the harbour; and towards the land, beſides the wall, there is a ditch. Four rivulets run through the town; and the tide of the Ouſe, which is about as broad here as the Thames at London-bridge, riſes 20 feet perpendicular. In the great market-place a ſtatue was erected in 1686 to the honour of king James II. There is another ſpacious market-place, adorned with a ſtatue of king William III. and a fine croſs with a dome and gallery round it ſupported by 16 pillars. The market-houſe is of free-ſtone, ſupported by 16 columns; and is 70 feet high, erected on four ſteps, neatly adorned with ſtatues, &c. Every firſt Monday in the month, the mayor, aldermen, preachers, &c. meet to hear and determine all controverſies amicably, for preventing law-ſuits. This was firſt eſtabliſhed in 1588, and is called *The Feaſt of Reconciliation*. The markets are on Tueſdays and Saturdays; and it has two fairs: one of which, beginning Feb. 14. laſts for a fortnight, and is called Lynn-mart; the other is a cheeſe-fair on Oct. 6. The adherence of this town to king John and to Henry VIII. as abovementioned, are not the only inſtances of its loyalty to its ſovereigns; for, in the late civil wars, it held out for king Charles I. and ſuſtained a formal ſiege of above 18,000 men of the parliament-army, for above three weeks; but, for want of relief, was obliged to ſurrender, and ſubmit to the terms of paying 10s. a-head for every inhabitant, and a month's pay to the ſoldiers, to ſave the town from plunder. There are more gentry, and conſequently more gaiety in this town than in Yarmouth or even Norwich; there being ſuch plenty of eatables and drinkables, that Spelman ſays Ceres and Bacchus ſeem to have eſtabliſhed their magazines at this place; the eaſt ſide abounding with corn, ſheep, rabbits, hares, &c. the weſt ſide with cheeſe, butter, black-cattle, ſwans, and the wild-fowl common to marſhes, beſides the abundance of ſea and river fiſh; ſo that he thinks there is no place in Great Britain, if in Europe, has ſuch a variety in ſo ſmall a compaſs of ground. At a ſmall diſtance from the town ſtands a mount called the Lady's or Red Mount, where was once a chapel dedicated to the Virgin Mary, which was a reſting-place for pilgrims on their way towards her convent at Walſingham. The king's ſtaith-yard, or quay, where the greateſt part of the imported wines is landed and put into large vaults, is a handſome ſquare, with brick buildings, in the centre whereof is a ſtatue of king James I. People paſs hence into the fen-country, and over the famous waſhes into Lincolnſhire in boats, which are often loſt, by venturing out at an improper ſeaſon and without guides.

LYNX, in zoology. See Felis.

LYON *King of Arms*. See King; and Law, n° clviii. 16.

This office is of great antiquity and reſpect in Scotland; and although the preciſe time of its inſtitution is unknown, yet it muſt have been as early as the introduction of armorial figures as hereditary marks of gentility and diſtinction into that country, which was in the 12th century. His regalia are, a crown of gold, with a crimſon velvet-cap, a gold taſſel, and an ermine lining; a velvet-robe reaching to his feet, with the arms of the kingdom embroidered thereon before and behind in the proper tinctures; a triple row of gold chain round his neck, with an oval gold medal pendant thereto, on one ſide of which is the royal bearing, and on the other St Andrew with his croſs enamelled in proper colours, and a baton of gold enamelled green powdered with the badges of the kingdom. The Lord Lyon's rank is ſuperior to that of any other king of arms, as he holds his office immediately from the ſovereign by commiſſion under the great ſeal; whereas the kings of arms in England are deputies to the Earl Marſhal, and act under his authority. Formerly Scotland was divided into two provinces, the one on the north and the other on the ſouth ſide of Forth; and theſe provinces were under the management of two deputies appointed by the Lord Lyon to ſuperintend the execution of all the buſineſs of his office. Before the revolution, the Lord Lyon, at his admiſſion into office, was moſt ſolemnly crowned by the ſovereign or his commiſſioner, in preſence of the nobility, the officers of ſtate, and other great men, after a ſuitable ſermon preached in the royal chapel; and his crown was of the ſame form with the imperial crown of the kingdom. On ſolemn occaſions he wears the regalia above deſcribed; at all other times, he wears the oval gold medal or badge on his breaſt, ſuſpended by a broad green ribbon. He has the abſolute diſpoſal of all the offices in his own court, and of the heralds and purſuivants places. The meſſengers at arms throughout Scotland are alſo created by him, and are amendable to his juriſdiction. And the powers veſted in him by his commiſſion are the ſame with thoſe of the ſovereign in all matters relative to the marks of gentility.

LYONET (Peter), an ingenious naturaliſt, and member of ſeveral learned ſocieties, was born at Mæſtricht, and was deſcended from a very ancient and reſpectable family of Lorrain. He had ſcarcely attained his ſeventh year before he diſplayed an uncommon ſtrength and agility in all bodily exerciſes; but he was not leſs diligent in the improvement of his mind. Being placed at the Latin ſchool, he learned chronology, and exerciſed himſelf in Latin, Greek, and French poetry, as alſo in Hebrew, logic, and the Carteſian Phyſics. He was particularly fond of the ſtudy of languages, whereof he underſtood no leſs than nine, living and dead. Having entered the univerſity of Leyden, he ſtudied the Newtonian philoſophy, geometry, algebra, &c.; but his father (who was a clergyman), deſiring he ſhould attach himſelf to divinity, he reluctantly abandoned the former ſtudies, as his paſſion for them was not eaſily to be overcome. He at the ſame time applied himſelf to anatomy, and alſo to muſic and drawing. He began afterwards to practiſe ſculpture: and performed ſeveral pieces in wood, ſome of which are preſerved, and have been greatly admired by the artiſts. After this, he betook himſelf to drawing portraits of his friends from life; wherein, after three or four months practice, he became a great proficient. Having attained the degree of candidate in divinity, he reſolved to ſtudy law, to which he applied himſelf with ſo much zeal, that he was promoted at the end of the firſt year. Arrived at the Hague, he undertook the ſtudy of decyphering; and became ſecretary of the cyphers, tranſlator of the Latin and French languages, and patent-maſter, to their High Mightineſſes. Meanwhile, having taken a ſtrong liking to the ſtudy of inſects, he undertook an hiſtorical deſcription of ſuch as are found about the Hague, and to that end collected materials for ſeveral volumes; and having invented a method of drawing adapted thereto, he enriched this work with a great number of plates, univerſally admired by all the connoiſſeurs who had ſeen them. In the year 1742 was printed at the Hague a French tranſlation of a German work, the 'Theology of Inſects,' by Mr Leſſer. Love of truth engaged Mr Lyonet to defer the publication of his above-mentioned deſcription, and to make ſome obſervations on that work, to which he has added two moſt beautiful plates, engraved from his deſigns. This performance cauſed his merit to be univerſally known and admired. The celebrated M. de Reaumur had the above tranſlation reprinted at Paris, not ſo much on account of the work itſelf as of Mr Lyonet's obſervations; and beſtowed on it, as did alſo many other authors, the higheſt encomiums. He afterwards executed drawings of the freſh water polypus for Mr Trembley's beautiful work, 1744. The ingenious Wandelaar had engraved the firſt five plates; when Mr Lyonet, who had never witneſſed this operation, concerned at the difficulties he experienced in getting the remaining eight finiſhed in the ſuperior ſtyle he required, reſolved to perform the taſk himſelf. He accordingly took a leſſon of one hour of Mr Wandelaar, engraved three or four ſmall plates, and immediately began upon the work itſelf, which he performed in ſuch a manner as drew on him the higheſt degree of praiſe, both from Mr Trembley and from many other artiſts, particularly the celebrated Van Gool; who declared that the performance aſtoniſhed not only the amateurs, but alſo the moſt experienced artiſts. In 1748 he was choſen member of the Royal Society of London. In 1749 he began (by mere chance) his amazing collection of horns and ſhells, which, according to the univerſal teſtimony of all travellers and amateurs who have viſited it, is at preſent the moſt beautiful, and certainly one of the moſt valuable, in Europe. In 1753 he became member of the newly-eſtabliſhed Dutch Society of Sciences at Haerlem; and in 1757, after the celebrated M. le Cat, profeſſor in anatomy and ſurgery, and member of almoſt all the principal ſocieties in Europe, had ſeen Mr Lyonet's incomparable *Traité Anatomique de la Chenille qui ronge le Bois de Saule*, with the drawings belonging to it (which work was afterwards publiſhed), he was elcted member of the Royal Academy of Sciences of Rome, whereof M. le Cat was perpetual ſecretary. After the publication of this treatiſe, he became, in 1760, member of the Royal Academy of Sciences of Berlin; in 1761, of the Imperial Academy of Naturaliſts; and, in 1762, of the Imperial Academy of Sciences at St Peterſburg. In order to enable ſuch as might be deſirous of following him in his intricate and moſt aſtoniſhing diſcoveries reſpecting the ſtructure of this animal, Mr Lyonet publiſhed, in the 'Tranſactions of the Dutch Society of Sciences at Haerlem,' a deſcription and a plate (as he alſo afterwards did in French at the beginning of his *Traité Anatomique*) of the inſtrument and tools he had invented for the purpoſe of diſſection, and likewiſe of the method he uſed to aſcertain the degree of ſtrength of his magnifying glaſſes. Notwithſtanding all this labour, which was conſiderably increaſed by the extenſive correſpondence whch he for many years carried on with ſeveral learned and reſpectable perſonages, he ſtill found means to ſet apart a large proportion of his time (as he himſelf mentions it in his preface) for the immediate ſervice of his country; but was not fortunate enough (as appears by his writings) to get any other recompence for his exertions than ſorrow and diſappointment.—During the laſt fifteen or twenty years of his life, Mr Lyonet added to the valuable treaſure he had already collected of natural curioſities, a moſt ſuperb cabinet of paintings, conſiſting of more than 560 performances; among which are many of the moſt eminent works of the firſt Dutch maſters. He did this with a view to procure himſelf ſome amuſement during the latter part of his life, when old age and infirmities muſt weaken his powers, and ſet bounds to his activity. He had always indeed accuſtomed himſelf to employment, inſomuch that he has written ſome pieces of Dutch poetry; and this diſpoſition remained with him till within a fortnight of his death, when he was attacked with an inflammation in his breaſt, which, though apparently cured, was, in the end, the cauſe of his diſſolution. He died at the Hague in January 1789, aged 83 years, leaving behind him a moſt eſtimable character.

LYONNOIS, a large province of France; bounded on the north by Burgundy; on the eaſt, by Dauphiny, Breſſe, and the principality of Dombs; on the ſouth, by Vivarais and Velay; and on the weſt, by Auvergne and a ſmall part of Bourbonnois. It comprehends Lower Lyonnois, Beaujolois, and Forez; and it produces corn, wine, fruits, and more eſpecially excellent cheſnuts. The principal rivers are the Soane, the Rhone, and the Loire. Lyons is the capital town.

LYONS, a large, rich, handſome, ancient, and famous town of France, being the moſt conſiderable in the kingdom, next to Paris, with an archbiſhop's ſee, an academy of ſciences and belles lettres, and an academy of arts and ſciences ſettled here in 1736. It is ſeated in the centre of Europe, on the confluence of the rivers Rhone and Soane: on the ſide of it are two high mountains; and the mountain of St Sebaſtian ſerves as a bulwark againſt the north winds, which often blow here with great violence. It contains about 150,000 inhabitants; and the houſes, in general, are high and well built. It has ſix gates, and as many ſuburbs. The town-houſe, the arſenal, the amphitheatre built by the ancient Romans, the hoſpital, and the numerous palaces, are worthy of a traveller's attention. The cathedral is a ſuperb ſtructure, and the canons that compoſe the chapter are all perſons of diſtinction. It is a place of very great trade, which is extended not only through France, but to Italy, Swiſſerland, and Spain; and there are four celebrated fairs every year, which are frequented by great numbers of people. It derives vaſt advantages from the rivers it ſtands upon; and is ſituated in E. Long. 4. 55. N. Lat. 45. 46.

LYRA, in ichthyology. See CALLYONIMUS.

LYRA, in aſtronomy, a conſtellation in the northern hemiſphere. The number of its ſtars, in Ptolemy's catalogue, is ten; in Tycho's eleven; in Hevelius's ſeventeen; and in the Britannic catalogue twenty-one.

LYRE, a muſical inſtrument of the ſtringed kind, much uſed by the ancients.

Concerning the number of ſtrings with which this inſtrument was furniſhed, there is great controverſy. Some aſſert it to be only three; and that the ſounds of the two remote were acute, and that of the intermediate one a mean between thoſe two extremes: that Mercury, the inventor, reſembled thoſe three chords to as many ſeaſons of the year, which were all that the Greeks reckoned, namely, Summer, Winter, and Spring: aſſigning the acute to the firſt, the grave to the ſecond, and the mean to the third.

Others aſſert that the lyre had four ſtrings; that the interval between the firſt and the fourth was an octave; that the ſecond was a fourth from the firſt, and the fourth the ſame diſtance from the third, and that from the ſecond to the third was a tone.

Another claſs of writers contend that the lyre of Mercury had ſeven ſtrings. Nichomacus, a follower of Pythagoras, and the chief of them, gives the following account of the matter: "The lyre made of the ſhell was invented by Mercury; and the knowledge of it, as it was conſtructed by him of ſeven ſtrings, was tranſmitted to Orpheus: Orpheus taught the uſe of it to Thamyris and Linus; the latter of whom taught it to Hercules, who communicated it to Amphion the Theban, who built the ſeven gates of Thebes to the ſeven ſtrings of the lyre." The ſame author proceeds to relate, "That Orpheus was afterwards killed by the Thracian women; and that they are reported to have caſt his lyre into the ſea, which was afterwards thrown up at Antiſſa, a city of Leſbos: that certain fiſhers finding it, they brought it to Terpander, who carried it to Egypt, exquiſitely improved, and, ſhowing it to the Egyptian prieſts, aſſumed to himſelf the honour of its invention."

This difference among authors ſeems to have ariſen from their confounding together the Egyptian and the Grecian Mercuries.—The invention of the primitive lyre with three ſtrings was due to the firſt Egyptian HERMES, as mentioned under that article.—The lyre attributed to the Grecian Mercury is deſcribed by almoſt all the poets to be an inſtrument of ſeven ſtrings†. Vincenzio Galilei has collected the various opinions of the ſeveral Greek writers who have mentioned the invention of the cheleys or teſtudo; and the late Mr Spence has done the ſame in a very circumſtantial but ludicrous manner. "Horace talks of Mercury as a wonderful muſician, and repreſents him with a lyre. There is a ridiculous old legend relating to this invention, which informs us, that Mercury, after ſtealing ſome bulls from Apollo, retired to a ſecret grotto, which he uſed to frequent, at the foot of a mountain in Arcadia. Juſt as he was going in, he found a tortoiſe feeding at the entrance of his cave: he killed the poor creature, and, perhaps, eat the fleſh of it. As he was diverting himſelf with the ſhell, he was mightily pleaſed with the noiſe it gave from its concave figure. He had poſſibly been cunning enough to find out, that a thong pulled ſtraight and faſtened at each end, when ſtruck by the finger, made a ſort of muſical ſound. However that was, he went immediately to work, and cut ſeveral thongs out of the hides he had lately ſtolen, and faſtened them as tight as he could to the ſhell of this tortoiſe; and, in playing with them, made a new kind of muſic with them to divert himſelf in his retreat."

† See *Mercury*.

retreat." This, conſidered only as an account of the firſt invention of the lyre, is not altogether ſo unnatural.

The moſt ancient repreſentations of this inſtrument agree very well with the account of its invention: the lyre, in particular on the old celeſtial globes, was repreſented as made of one entire ſhell of a tortoiſe; and that Amphion in the celebrated group of the Dirce or Toro, in the Farneſe palace at Rome, which is of Greek ſculpture, and very high antiquity, is figured in the ſame manner.

There have, however, been many other claimants to the ſeven-ſtringed lyre. For though Mercury invented this inſtrument in the manner already related, it is ſaid he afterwards gave it to Apollo, who was the firſt that played upon it with method, and made it the conſtant companion of poetry. According to Homer's account of this tranſaction, in his hymn to Mercury, it was given by that god to Apollo, as a peace-offering and indemnification for the oxen which he had ſtolen from him:

> To Phœbus Maia's ſon preſents the lyre,
> A gift intended to appeaſe his ire.
> The god receives it gladly, and eſſays
> The novel inſtrument a thouſand ways;
> With dext'rous ſkill the plectrum wields; and ſings,
> With voice accordant to the trembling ſtrings,
> Such ſtrains as gods and men approv'd from whence
> The ſweet alliance ſprung of ſound and ſenſe.

Diodorus informs us, that Apollo ſoon repenting of the cruelty with which he had treated Marſyas in conſequence of their muſical conteſt, broke the ſtrings of the lyre, and by that means put a ſtop for a time to any further progreſs in the practice of that new inſtrument. "The muſes (adds he) afterwards added to this inſtrument the ſtring called *meſe*; Linus, that of *lichanos*; and Orpheus and Thamyras, thoſe ſtrings which are named *hypate* and *parhypate* (A).

Again, many ancient and reſpectable authors tell us, that, before the time of Terpander, the Grecian lyre had only four ſtrings; and, if we may believe Suidas, it remained in this ſtate 856 years, from the time of Amphion, till Terpander added to it three new ſtrings, which extended the muſical ſcale to a heptachord, or ſeventh, and ſupplied the player with two conjoint tetrachords. It was about 150 years after this period, that Pythagoras is ſaid to have added an eighth ſtring to the lyre, in order to complete the octave, which conſiſted of two disjoint tetrachords.

Boethius gives a different hiſtory of the ſcale, and tells us, that the ſyſtem did not long remain in ſuch narrow limits as a tetrachord. Choræbus, the ſon of Athias, or Atys, king of Lydia, added a fifth ſtring; Hyagnis, a ſixth; Terpander, a ſeventh; and, at length, Lychaon of Samos, an eighth. But all theſe accounts are irreconcileable with Homer's hymn to Mercury, where the chelys, or teſtudo, the invention of which he aſcribes to that god, is ſaid to have had ſeven ſtrings. There are many claimants among the muſicians of ancient Greece to the ſtrings that were afterwards added to theſe, by which the ſcale, in the time of Ariſtoxenus, was extended to two octaves. Athenæus, more than once, ſpeaks of the nine-ſtringed inſtrument; and Ion of Chios, a tragic and lyric poet and philoſopher, who firſt recited his pieces in the 82d olympiad, 452 B. C. mentions, in ſome verſes quoted by Euclid, the ten ſtringed lyre; a proof that the third conjoint tetrachord was added to the ſcale in his time, which was about 50 years after Pythagoras is ſuppoſed to have conſtructed the octachord.

The different claimants among the Greeks to the ſame muſical diſcoveries, only prove, that muſic was cultivated in different countries; and that the inhabitants of each country invented and improved their own inſtruments, ſome of which happening to reſemble thoſe of other parts of Greece, rendered it difficult for hiſtorians to avoid attributing the ſame invention to different perſons. Thus the ſingle flute was given to Minerva and to Marſyas; the ſyrinx or fiſtula, to Pan and to Cybele; and the lyre or chithara, to Mercury, Apollo, Amphion, Linus, and Orpheus. Indeed, the mere addition of a ſtring or two to an inſtrument without a neck, was ſo obvious and eaſy, that it is ſcarce poſſible not to conceive many people to have done it at the ſame time.

With reſpect to the form of the ancient lyre, as little agreement is to be found among authors as about the number of ſtrings. The beſt evidences concerning it are the repreſentations of that inſtrument in the hands of ancient ſtatues, baſs-reliefs, &c. See Plate CCLXXV. where,

Fig. 1. is a repreſentation of the teſtudo, or lyre of Amphion, in front, as it appears on the baſe of the celebrated Toro Farneſe at Rome. This admirable work, conſiſting of four figures bigger than the life, beſides the toro, or bull, was found in Caracalla's baths, where the Farneſe Hercules was likewiſe diſcovered; and, ex-

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(A) It has been already related, that the lyre invented by the Egyptian Mercury had but three ſtrings; and by putting theſe two circumſtances together, Dr Burney obſerves, that we may perhaps acquire ſome knowledge of the progreſs of muſic, or at leaſt, of the extenſion of its ſcale, in the higheſt antiquity.

Meſe, in the Greek muſic, is the fourth ſound of the ſecond tetrachord of the great ſyſtem, and firſt tetrachord invented by the ancients, anſwering to our A, on the fifth line in the baſe. If this ſound then was added to the former three, it proves two important points: firſt, that the moſt ancient tetrachord was that from E in the baſe to A; and that the three original ſtrings in the Mercurian and Apollonian lyre were tuned E, F, G, which the Greeks called *Hypate Meſon*, *Parhypate Meſon*, *Meſon Diatonos*. The addition therefore of *Meſe* to theſe, completed the firſt and moſt ~~ancient~~ tetrachord, E, F, G, A.

The ſtring *lichanos*, then, being added to theſe, and anſwering to our D on the third line in the baſe, extended the compaſs downwards, and gave the ancient lyre a regular ſeries of five ſounds in the Dorian mode, the moſt ancient of all the Greek modes; and the two ſtrings called *Hypate* and *Parhypate*, correſponding with our B and C in the baſe, completed the heptachord, or ſeven ſounds, B, C, D, E, F, G, A, a compas that received no addition till after the time of Pindar, who calls the inſtrument then in uſe the *ſeven-tongued lyre*.

cept the Laocoon, is the only piece of Greek ſculpture mentioned by Pliny that is now remaining. The two projections near the bottom ſeem to have been faſtenings for the ſtrings, and to have anſwered the purpoſe of tail-pieces in modern inſtruments.

2. The lyre held by Terpſichore, in the picture of that muſe dug out of Herculaneum.

3. The Abyſſinian teſtudo, or lyre in uſe at preſent in the province of Tigre, from a drawing of Mr Bruce, communicated to Dr Burney. “This inſtrument (ſays he) has ſometimes five, ſometimes ſix, but moſt frequently ſeven ſtrings, made of the thongs of raw ſheep or goat ſkins, cut extremely fine, and twiſted; they rot ſoon, are very ſubject to break in dry weather, and have ſcarce any ſound in wet. From the idea, however, of this inſtrument being to accompany and ſuſtain a voice, one would think that it was better mounted formerly. “The Abyſſinians have a tradition, that the ſiſtrum, lyre, and tambourine, were brought from Egypt into Ethiopia, by Thot, in the very firſt ages of the world. The flute, kettle-drum, and trumpet, they ſay, were brought from Paleſtine, with Menelek, the ſon of their queen of Saba by Solomon, who was their firſt Jewiſh king.

“The lyre in Amharic is called *beg*, ‘the ſheep;’ in Ethiopic, it is called *meſinko*; the verb *ſinko* ſignifies to ſtrike ſtrings with the fingers: no plectrum is ever uſed in Abyſſinia; ſo that meſiko, being literally interpreted, will ſignify the ‘ſtringed inſtrument played upon with the fingers.’

“The ſides which conſtitute the frame of the lyre were anciently compoſed of the horns of an animal of the goat kind called *agazan*, about the ſize of a ſmall cow, and common in the province of Tigre. I have ſeen ſeveral of theſe inſtruments very elegantly made of ſuch horns, which nature ſeems to have ſhaped on purpoſe. Some of the horns of an African ſpecies of this animal may be ſeen in M. Buffon's hiſtory of the king of France's cabinet. They are bent, and leſs regular than the Abyſſinian; but after fire-arms became common in the province of Tigre, and the woods were cut down, this animal being more ſcarce, the lyre has been made of a light red wood; however, it is always cut into a ſpiral twiſted form, in imitation of the ancient materials of which the lyre was compoſed. The drawing I ſend you was one of theſe inſtruments made of wood.

“The kingdom of Tigre, which is the largeſt and moſt populous province of Abyſſinia, and was during many ages the ſeat of the court, was the firſt which received letters and civil and religious government; it extended once to the Red Sea: various reaſons and revolutions have obliged the inhabitants to reſign their ſeacoaſt to different barbarous nations, Pagan and Mahometan; while they were in poſſeſſion of it, they ſay that the Red Sea furniſhed them with tortoiſe ſhells, of which they made the bellies of their lyres, as the Egyptians did formerly, according to Apollodorus and Lucian; but having now loſt that reſource, they have adopted, in its place, a particular ſpecies of gourd, or pumpkin, very hard and thin in the bark, ſtill imitating with the knife the ſquares, compartments, and figure of the ſhell of the tortoiſe.

“The lyre is generally from three feet to three feet ſix inches high; that is, from a line drawn thro' the point of the horns, to the lower part of the baſe of the ſounding-board. It is exceedingly light, and eaſy of carriage, as an inſtrument ſhould naturally be in ſo rugged and mountainous a country.

“When we conſider the parts which compoſe this lyre, we cannot deny it the earlieſt antiquity. Man in his firſt ſtate was a hunter and a fiſher, and the oldeſt inſtrument was that which partakes moſt of that ſtate. The lyre compoſed of two principal pieces, owes the one to the horns of an animal, the other to the ſhell of a fiſh.

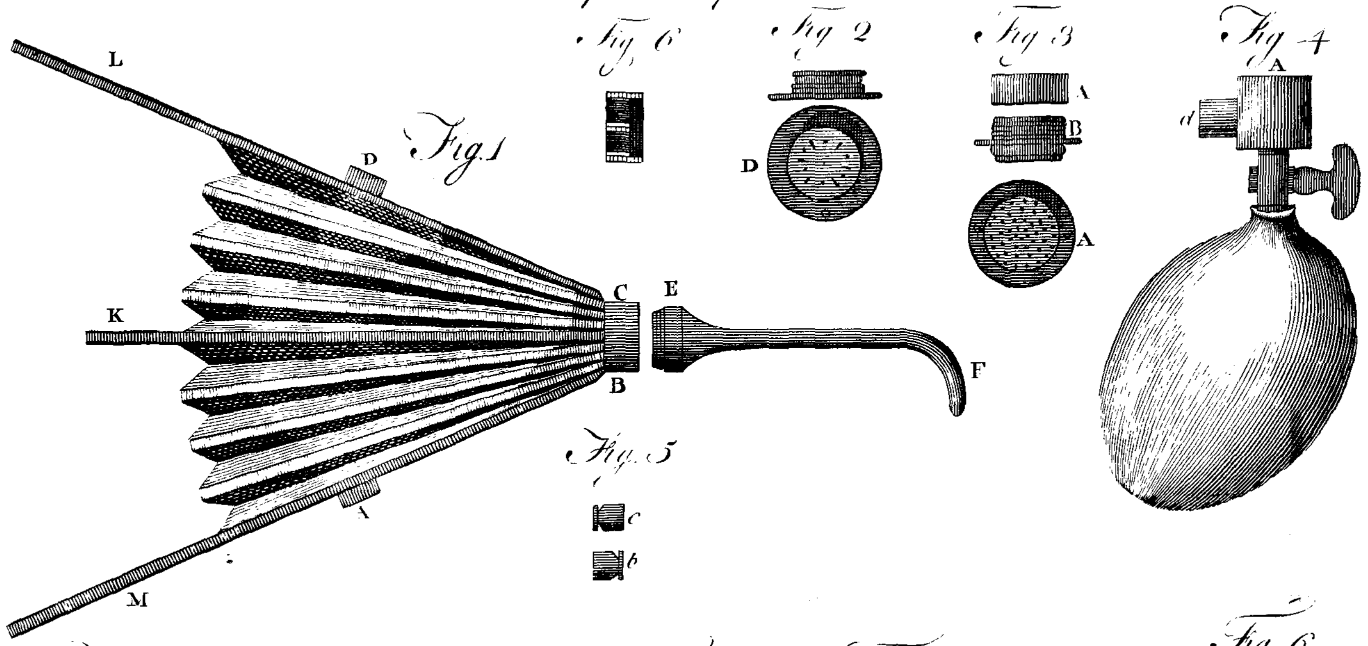
“It is probable, that the lyre continued with the Ethiopians in this rude ſtate as long as they confined themſelves to their rainy, ſteep, and rugged mountains; and afterwards, when many of them deſcended along the Nile in Egypt, its portability would recommend it in the extreme heats and wearineſs of their way. Upon their arrival in Egypt, they took up their habitation in caves, in the ſides of mountains, which are inhabited to this day. Even in theſe circumſtances, an inſtrument larger than the lyre muſt have been inconvenient and liable to accidents in thoſe caverns; but when theſe people increaſed in numbers and courage, they ventured down into the plain, and built Thebes. Being now at their eaſe, and in a fine climate, all nature ſmiling around them, muſic and other arts were cultivated and refined, and the imperfect lyre was extended into an inſtrument of double its compaſs and volume. The ſize of the harp could be now no longer an objection; the Nile carried the inhabitants every where eaſily and without effort; and we may naturally ſuppoſe in the fine evenings of that country, that the Nile was the favourite ſcene upon which this inſtrument was practiſed; at leaſt the ſphinx and lotus upon its head, ſeem to hint that it was ſomeway connected with the overflowings of that river.” See Harp.

4. An Etruſcan lyre, with ſeven ſtrings, in the collection of Etruſcan, Greek, and Roman antiquities, publiſhed from the cabinet of the Hon. Sir William Hamilton, Vol. I. Naples 1766. Pl. cix. With reſpect to this inſtrument, it is worthy of obſervation, that though the vaſe upon which it is repreſented is of ſuch indiſputable and remote antiquity, the tail-piece, bridge, belly, and ſound holes have a very modern appearance, and manifeſt a knowledge in the conſtruction of muſical inſtruments among the Etruſcans ſuperior to that of the Greeks and Romans in much later times. The lower part of the inſtrument has much the appearance of an old baſs viol, and it is not difficult to diſcover in it more than the embyo of the whole violin family. The ſtrings lie round, as if intended to be played on with a bow; and even the croſs lines on the tail-piece are ſuch as we frequently ſee on the tail-pieces of old viols.

5. The Tripodian lyre of Pythagoras the Zacynthian, from a baſs-relief in the Maffei palace at Rome repreſenting the whole choir of the muſes. Athenæus gives the following account of this extraordinary inſtrument, *lib.* xiv. *cap.* 15. *p.* 637. “Many ancient inſtruments are recorded (ſays Artemon), of which we have ſo little knowledge, that we can hardly be certain of their exiſtence; ſuch as the tripod of Pythagoras the Zacynthian, which, on account of its difficulty, continued in uſe but a ſhort time. It reſembled in form the Delphic tripod, whence it had its name. The legs were equidiſtant, and fixed

Bellows for inflating the Lungs in order to restore suspended respiration

Plate CCLXXV



Ancient Lyres

Fig 1

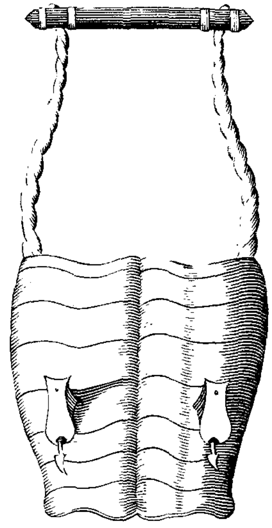


Fig 2

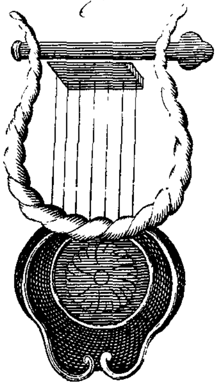


Fig 5

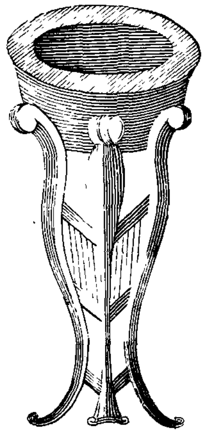


Fig 6

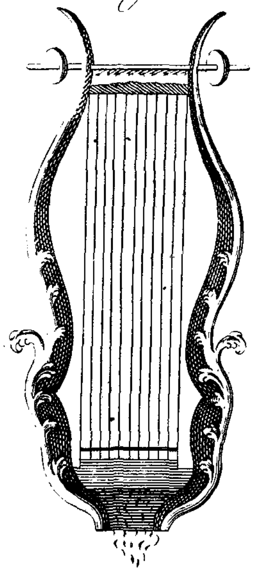
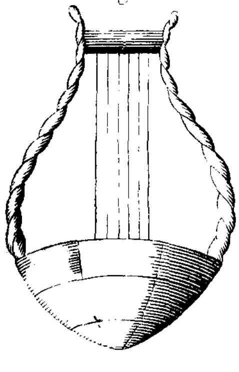


Fig 3



Lucanus

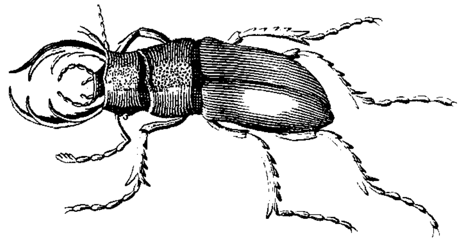
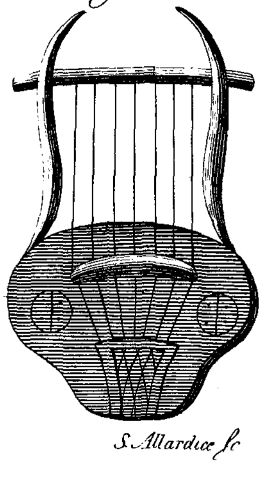


Fig. 4



S. Allardice sc

upon a moveable baſe that was turned by the foot of the player; the ſtrings were placed between the legs of the ſtool; the vaſe at the top ſerved for the purpoſe of a ſound board, and the ſtrings of the three ſides of the inſtrument were tuned to three different modes, the Doric, Lydian, and Phrygian. The performer ſat on a chair made on purpoſe; ſtriking the ſtrings with the fingers of the left hand, and uſing the plectrum with the right, at the ſame time turning the inſtrument with his foot to which ever of the three modes he pleaſed: ſo that by great practice he was enabled to change the modes with ſuch velocity, that thoſe who did not ſee him would imagine they heard three different performers playing in three different modes. After the death of this admirable muſician, no other inſtrument of the ſame kind was ever conſtructed."

6. A lyre in the famous ancient picture dug out of Herculaneum, upon which Chiron is teaching the young Achilles to play. See Chiron.

LYRIC-poetry, was ſuch as the ancients ſung to the lyre or harp.—It was originally employed in celebrating the praiſes of gods and heroes, and its characteriſtic was ſweetneſs. Who was the author of it is not known. It was much cultivated by the Greeks; and Horace was the firſt who attempted it in the Latin language. Anacreon, Alcæus, Steſichorus, Sappho, and Horace, were the moſt celebrated lyric poets of antiquity.

LYRODI, among the ancients, a kind of muſicians who played on the lyre and ſung at the ſame time. This appellation was alſo given to ſuch as made it their employment to ſing lyric poems compoſed by others.

LYS, or Lis. See Lis.

Lys, the name of a meaſure uſed by the Chineſe in eſtimating diſtances. Two hundred lys make 60 geographical miles, which are equal to one degree.

LYSANDER, a famous Spartan general. See Sparta.

LYSANDRIA, a Samian feſtival, celebrated with games and ſacrifices in honour of the Lacedemonian general Lyſander. It was anciently called *herea;* but this name the Samians aboliſhed by a public decree.

LYSIARCH, an ancient magiſtrate, who ſuperintended the ſacred games, and preſident in matters of religion in the province of Lycia. He was created in a council conſiſting of deputies from all the provincial cities, in number 23. The lyſiarchs were both heads of the council and pontiffs of the province.

LYSIAS, an ancient Grecian orator, was born at Syracuſe in the 80th olympiad. At 15, he went to Thurion, a colony of the Athenians; and when grown up, aſſiſted in the adminiſtration of the government there many years. When about 47 years of age, he returned to Athens; whence, being afterwards baniſhed by the 30 tyrants, he went to Megara. Upon his return, Thraſybulus would have had him employed again in ſtate matters; but this not taking place, he ſpent the remainder of his life as a private man. He was very familiar with Socrates, and other illuſtrious philoſophers. He profeſſed to teach the art of ſpeaking; not that he pleaded at the bar himſelf, but he ſupplied others with ſpeeches. "Fuit Lyſias in cauſis forenſibus non verſatus" (ſays Cicero), ſed egregie ſubtilis ſcriptor atque elegans," &c. Quintilian calls him, "ſubtilis atque elegans, et quo nihil, ſi Oratorio ſatis ſit docere, quæras perfectius. Nihil enim eſt inane, nihil arceſſitum; puro tamen fonti, quam magno flumini, proprior." Plutarch and Photius relate that 425 orations were formerly exhibited under the name of Lyſias; of which 34 only are now extant. The beſt edition of them is by Dr John Taylor at London, 1739, 4to; Cambridgo, 1740, 8vo.

LYSIMACHIA, loosestrife, in botany: A genus of the monogynia order belonging to the pentandria claſs of plants; and in the natural method ranking under the 20th order, *Rotaceæ.* The corolla is rotaceous; the capſule globular, beaked, and tenvalved. There are ten ſpecies, but only four are commonly cultivated in gardens. Theſe are hardy, herbaceous perennials and biennials, riſing with erect ſtalks from 18 inches to two or three feet high; garniſhed with narrow entire leaves; and terminated by ſpikes and cluſters of monopetalous, rotated, fiveparted ſpreading flowers of white and yellow colours.—They are eaſily propagated by ſeeds, and will thrive in any ſoil or ſituation.

LYSIPPUS, a celebrated Greek ſtatuary, was born at Sicyone, and at firſt followed the buſineſs of a lockſmith which he quitted in order to practiſe painting: But he afterwards applied himſelf entirely to ſculpture; in which he acquired an immortal reputation, and made a great number of ſtatues that were the admiration of the people of Athens and Rome. His grand ſtatue of the ſun repreſented in a car drawn by four horſes, was worſhipped at Rhodes; he made ſeveral ſtatues of Alexander and his favourites, which were brought to Rome by Metellus after he had reduced the Macedonian empire; and the ſtatue of a man wiping and anointing himſelf after bathing, being particularly excellent, was placed by Agrippa before his baths in that city. He lived in the time of Alexander the Great, about 334 B. C.; and left three ſons, who were all famous ſtatuaries.

LYTHRUM, purple loosestrife, in botany. A genus of the monogynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 17th order, *Calycanthemæ.* The calyx is cleft in 12 parts; and there are ſix petals inſerted into it; the capſule is bilocular and polyſpermous. There are 10 ſpecies, of which the moſt remarkable are, 1. The ſalicaria, or common purple looſeſtrife, with oblong leaves, is a native of Britain, and grows naturally by the ſides of ditches and rivers. It hath a perennial root, from which come forth ſeveral upright angular ſtalks, riſing from three to four feet high, garniſhed with oblong leaves placed ſometimes by pairs; but ſometimes there are three leaves at each joint ſtanding round the ſtalk. The flowers are purple, and produced in a long ſpike at the top of the ſtalk; ſo make a fine appearance. 2. The hyſpanum, or Spaniſh looſeſtrife, with an hyſſop leaf, grows naturally in Spain and Portugal. It hath a perennial root. The ſtalks are ſlender, not more than nine or ten inches long, ſpreading out on every ſide. The lower part of the ſtalks is garniſhed with oblong oval leaves placed oppoſite. The flowers come out ſingly from the ſide of the ſtalks at each joint; they are larger than thoſe of the common ſort, and make a fine appearance in the month of July when they are in beauty. The firſt kind is propagated by parting the roots in autumn, but requires a moiſt ſoil;—the ſecond is propagated by ſeeds brought from thoſe countries where it is native.

LYTTELTON (Edward), lord Lyttelton, keeper of the great ſeal in the reign of Charles I. was eminent for his probity and his moderation at the commencement of that monarch's diſputes with his ſubjects. Without forfeiting his fidelity to the king, he preſerved the eſteem of the parliament till 1644, when he was made colonel of a regiment in the king's army at York. He died in 1645. Beſides ſeveral of his ſpeeches which have been printed, he wrote reports in the common pleas and exchequer printed at London in 1683, in folio; ſeveral arguments and diſcourſes, &c.

LYTTELTON (George lord) eldeſt ſon of Sir Thomas Lyttelton, bart. deſcended from the great judge Lyttelton, was born in 1700, at ſeven months; and the midwife ſuppoſing him to be dead, threw him careleſsly into the cradle; where, had not ſome ſigns of life been taken notice of by one of the attendants, he might never have recovered. He received the elements of his education at Eaton-ſchool, where he ſhowed an early inclination to poetry. His paſtorals and ſome other light pieces were originally written in that ſeminary of learning; from whence he was removed to the univerſity of Oxford, where he purſued his claſſical ſtudies with uncommon avidity, and ſketched the plan of his Perſian Letters, a work which afterwards procured him great reputation, not only from the elegance of the language in which they were compoſed, but from the excellent obſervations they contained on the manners of mankind.

In the year 1728, he ſet out on the tour of Europe; and, on his arrival at Paris, accidentally became acquainted with the honourable Mr Poyntz, then the Britiſh miniſter at the court of Verſailles; who was ſo ſtruck with the extraordinary capacity of our young traveller, that he invited him to his houſe, and employed him in many political negociations, which he executed with great judgment and fidelity.

Mr Lyttelton's conduct, while on his travels, was a leſſon of inſtruction to the reſt of his countrymen. Inſtead of lounging away his hours at the coffee-houſes frequented by the Engliſh, and adopting the faſhionable follies and vices of France and Italy, his time was paſſed alternately in his library and in the ſociety of men of rank and literature. In this early part of his life, he wrote a poetical epiſtle to Dr Ayſcough, and another to Mr Pope, which ſhow ſingular taſte and correctneſs.

After continuing a conſiderable time at Paris with Mr Poyntz, who, to uſe his own words, behaved like a ſecond father to him, he proceeded to Lyons and Geneva; and from thence to Turin, where he was honoured with great marks of friendſhip by his Sardinian majeſty. He then viſited Milan, Venice, Genoa, and Rome, where he applied himſelf cloſely to the ſtudy of the fine arts; and was, even in that celebrated metropolis, allowed a perfect judge of painting, ſculpture, and architecture.

During his continuance abroad, he conſtantly correſponded with Sir Thomas, his father. Several of his letters are yet remaining, and place his filial affection in a very diſtinguiſhed light. He ſoon after returned to his native country, and was elected repreſentative for the borough of Okehampton in Devonſhire; and behaved ſo much to the ſatisfaction of his conſtituents, that they ſeveral times re-elected him for the ſame place without putting him to the leaſt expence.

About this period, he received great marks of friendſhip from Frederic prince of Wales, father of his preſent majeſty: and was, in the year 1737, appointed principal ſecretary to his royal highneſs, and continued in the ſtricteſt intimacy with him till the time of his death. His attention to public buſineſs did not, however, prevent him from exerciſing his poetical talent. A moſt amiable young lady, Miſs Forteſcue, inſpired him with a paſſion, which produced a number of little pieces, remarkable for their tenderneſs and elegance; and he had a happy facility of ſtriking out an extempore compliment, which obtained him no ſmall ſhare of reputation. One evening being in company with lord Cobham and ſeveral of the nobility at Stowe, his lordſhip mentioned his deſign of putting up a buſt of lady Suffolk in his beautiful gardens; and, turning to Mr Lyttelton, ſaid, "George, you muſt furniſh me with a motto for it." "I will, my lord," anſwered Mr Lyttelton; and directly produced the following couplet:

Her wit and beauty for a court were made,
But truth and goodneſs fit her for a ſhade.

When Mr Pitt, the late earl of Chatham, loſt his commiſſion in the guards, in conſequence of his ſpirited behaviour in parliament, Mr Lyttelton was in waiting at Leiceſter-houſe, and, on hearing the circumſtance, immediately wrote theſe lines:

Long had thy virtue mark'd thee out for fame,
Far, far ſuperior to a cornet's name;
This generous Walpole ſaw, and griev'd to find
So mean a poſt diſgrace that noble mind;
The ſervile ſtandard from thy free-born hand
He took, and bade thee lead the patriot-band.

In the year 1742, he married Lucy, the daughter of Hugh Forteſque, Eſq; of Filleigh in the county of Devon, the Lady abovementioned, whoſe exemplary conduct, and uniform practice of religion and virtue, eſtabliſhed his conjugal happineſs upon the moſt ſolid baſis.

In 1744, he was appointed one of the lords commiſſioners of the treaſury; and, during his continuance in that ſtation, conſtantly exerted his influence in rewarding merit and ability. He was the friend and patron of the late Henry Fielding, James Thomſon author of the Seaſons, Mr Mallet, Dr Young, Mr Hammond, Mr Weſt, Mr Pope, and Voltaire. On the death of Thomſon, who left his affairs in a very embarraſſed condition, Mr Lyttelton took that poet's ſiſter under his protection. He reviſed the tragedy of Coriolanus, which that writer had not put the laſt hand to; and brought it out at the theatre-royal, Covent-garden, with a prologue of his own writing, in which he ſo affectingly lamented the loſs of that delightful bard, that not only Mr Quin, who ſpoke the lines, but almoſt the whole audience, ſpontaneouſly burſt into tears.

In the beginning of the year 1746, his felicity was interrupted by the loſs of his wife, who died in the 29th year of her age; leaving him one ſon, Thomas, the late lord Lyttelton; and a daughter, Lucy, who ſome time ſince married lord viſcount Valentia. The remains of his amiable lady were depoſited at Over-Arley in Worceſterſhire; and an elegant monument was erected to her memory in the church of Hagley, which contains the following inſcription written by her huſband:

Made to engage all hearts, and charm all eyes:
Tho' meek, magnanimous; tho' witty, wiſe;
Polite, as all her life in courts had been;
Yet good, as ſhe the world had never ſeen:
The noble fire of an exalted mind,
With gentleſt female tenderneſs combin'd.
Her ſpeech was the melodious voice of love,
Her ſong the warbling of the vernal grove;
Her eloquence was ſweeter than her ſong,
Soft as her heart, and as her reaſon ſtrong.
Her form each beauty of her mind expreſs'd,
Her mind was virtue by the graces dreſs'd.

Beſides theſe beautiful lines, Mr Lyttleton wrote a monody on the death of his lady, which will be remembered while conjugal affection and a taſte for poetry exiſt in this country.

His maſterly obſervations on the converſion and apoſtleſhip of St Paul, were written at the deſire of Gilbert Weſt, in conſequence of Mr Lyttleton's aſſerting, that beſide, all the proofs of the Chriſtian religion, which might be drawn from the prophecies of the Old Teſtament, from the neceſſary connection it has with the whole ſyſtem of the Jewiſh religion, from the miracles of Chriſt, and from the evidence given of his reſurrection by all the other apoſtles, he thought the converſion of St Paul alone, duly conſidered, was of itſelf a demonſtration ſufficient to prove Chriſtianity to be a divine revelation. Mr Weſt was ſtruck with the thought; and aſſured his friend, that ſo compendious a proof would be of great uſe to convince thoſe unbelievers that will not attend to a longer ſeries of arguments; and time has ſhown he was not out in his conjecture, as the tract is eſteemed one of the beſt defences of Chriſtianity which has hitherto been publiſhed.

In 1754, he reſigned his office of lord of the treaſury, and was made cofferer to his majeſty's houſehold, and ſworn of the privy-council: Previous to which, he married, a ſecond time, Elizabeth daughter of field-marſhal Sir Robert Rich, whoſe indiſcreet conduct gave him great uneaſineſs, and from whom he was ſeparated by mutual conſent, a few years after his marriage.

After being appointed chancellor and under-treaſurer of the court of exchequer, he was, by letters-patent dated the 19th of November 1757, 31 Geo. II. created a peer of Great Britain, by the ſtyle and title of *Lord Lyttleton, baron of Frankley, in the county of Worceſter*. His ſpeeches on the Scotch and mutiny bills in the year 1747, on the Jew bill in 1753, and on the privilege of parliament in 1763, ſhowed ſound judgment, powerful eloquence, and inflexible integrity. During the laſt ten years he lived chiefly in retirement, in the continual exerciſe of all the virtues which can ennoble private life. His laſt work was Dialogues of the Dead, in which the morality of Cambray and the ſpirit of Fontenelle are happily united.

He was ſuddenly ſeized with an inflammation of the bowels, in the middle of July 1773, at his ſeat at Hagley; which terminated in his death, on the 22d of that month. His laſt moments were attended with unimpaired underſtanding, unaffected greatneſs of mind, calm reſignation, and humble but confident hopes in the mercy of God. As he had lived univerſally eſteemed, he died lamented by all parties. A complete collection of his works has been publiſhed ſince his deceaſe, by his nephew George Aſycough, Eſq.

M.

M, a liquid conſonant, and the twelfth letter in the alphabet.

It has one unvaried ſound, and is pronounced by ſtriking the upper lip againſt the lower; in which the pronunciation of this letter agrees with that of *b*; the only difference between the two conſiſting in a little motion made in the noſe in pronouncing *m*, and not in *b*: whence it happens that thoſe who have taken cold, for *m* ordinarily pronounce *b*; the noſe in that caſe being diſabled from making the neceſſary motion.

All conſonants are formed with the aid of vowels; in *em* the vowel precedes, in *be* it follows; and *m* is never mute.

Quintilian obſerves, that the *m* ſometimes ends Latin words, but never Greek ones; the Greeks always changing it in that caſe into *n*, for the ſake of the better ſound.

M is alſo a numeral letter, and among the ancients was uſed for a thouſand; according to the verſe,

M caput eſt numeri, quem ſcimus mille tenere.

When a daſh is added to the top of it, as $\overline{M}$; it ſignifies a thouſand times a thouſand.

M. as an abbreviature, ſtands for Manlius, Marcus, Martius, and Mucius: M. A. ſignifies *magiſter artium*, or maſter of arts; MS. manuſcript, and MSS. manuſcripts.

M, in aſtronomical tables, and other things of that kind, is uſed for *meridional* or ſouthern: and ſometimes for *meridian* or mid-day.

M. in medicinal preſcription, is frequently uſed to ſignify a maniple or handful: and it is ſometimes alſo put at the end of a recipe, for *miſce* "mingle;" or for *mixtura* "a mixture." Thus, *m. f. julapium*, ſignifies "mix and make a julep."

M. in law, the brand or ſtigma of a perſon convicted of manſlaughter, and admitted to the benefit of his clergy. It is to be burnt on the brawn of his left thumb.

MAAT (John). See Blankof.

MABA, in botany: A genius of the triandria order, belonging to the diœcia claſs of plants. The perianthium of the male is trifid; that of the female is as in the male; the fruit is a plum two-celled ſuperior.

MABILLON (John), a very learned writer of France in the 17th century, was born at Perre-monte, on the frontiers of Champagne, in 1632. He was educated in the univerſity of Rheims, and afterwards entered into the abbey of the Benedictines of St Remy. In the year 1663, he was appointed keeper of the treaſures and monuments of France at St Dennis; but having unfortunately broke a looking-glaſs there, which was pretended to have belonged to Virgil, he deſired leave of his ſuperiors to quit an employment which frequently obliged him to tell things he did not believe. Next year he went to Paris: and was very ſerviceable to Father d'Acheri, who was deſirous of having ſome young monk who could aſſiſt him in compiling his *Spicilegium*. This made him known. Soon after the congregation of St Maur having formed a deſign of publiſhing new editions of the fathers, reviſed from the MSS. in the libraries of the Benedictines, Mabillon was charged with the edition of St Bernard, which he prepared with extraordinary diligence. After that, he publiſhed many other works, which are evidences of his vaſt capacity and induſtry. In 1682, he was employed by Mr Colbert in examining ſome ancient titles relating to the royal family. The year following he ſent him into Germany, to ſearch the archives and libraries of the ancient abbeys for what was moſt curious and proper to illuſtrate the hiſtory of the church in general, and that of France in particular. He has publiſhed an account of this journey. In 1685, he undertook another journey into Italy, by order of the king of France; and returned the year following with a very noble collection. He placed in the king's library above 3000 volumes of rare books, printed and in MSS. and compoſed two volumes of the pieces which he had diſcovered in the country. He was highly eſteemed for his virtues as well as his learning.

MACACO, or Macauco. See Lemur.

MACAO, a town of China, in the province of Canton, ſeated in an iſland at the mouth of the river Tae. The Portugueſe have been in poſſeſſion of the harbour for 150 years. Formerly they had a great trade here; but now they have only a fort with a ſmall garriſon. The houſes are built after the European manner; and there is a Chineſe mandarin, as well as a Portugueſe governor, to take care of the town and the neighbouring country. E. Long. 112. 13. N. Lat. 22. 12.

Macao, in ornithology. See Psittacus.

MACARIANS, in eccleſiaſtical hiſtory, the followers of Macarius, an Egyptian monk, who was diſtinguiſhed towards the cloſe of the fourth century for his ſanctity and virtue. In his writings there are ſome ſuperſtitious tenets, and alſo certain opinions that ſeem tainted with Origeniſm. The name has been alſo applied to thoſe who adopted the ſentiments of Macarius a native of Ireland, who, about the cloſe of the ninth century, propagated in France the error afterwards maintained by Averrhoes that one individual intelligence or ſoul performed the ſpiritual and rational functions in all the human race.

MACARONI. See Folengio, and the next article.

MACARONIC, or Macaronian, a kind of burleſque poetry, conſiſting of a jumble of words of different languages, with words of the vulgar tongue Latinized, and Latin words modernized. *Maccaroni* among the Italians; as has been obſerved by Cælius Rhodiginus, ſignifies a *coarſe clowniſh man;* and becauſe this kind of poetry is patched out of ſeveral languages, and full of extravagant words, &c. the Italians, among whom it had its riſe, gave it the name of *macaronian*, or *macaronic* poetry. Others chooſe to derive it *à macaronibus*, from *macaroons*, a kind of confection made of meal not boulted, ſweet-almonds, ſugar, and the white of eggs, accounted a great dainty among the country-people in Italy; which, from their being compoſed of various ingredients, occaſioned this kind of poetry, which conſiſts of Latin, Italian, Spaniſh, French, Engliſh, &c. to be called by their name.

Example.—A bold fellow in the *macaronic* ſtyle, ſays,

Enfilavi omnes ſcradones & regimandos, &c.

Another example:

Archelos piſtoliferos furiamque manantum,
Et grandem eſmeutam quæ inopinum facta ruelle eſt:
Toxinumque alto troublantem corda clochero, &c.

Theoph. Folengius, a Benedictine monk of Mantua, was the firſt who invented, or at leaſt cultivated, this kind of verſe. See Folengio.

The beſt pieces of this kind are the *Baldus*, of Folengio, and *Macaronis Forza* by Stefonio a Jeſuit, among the Italians; and the *Beatus veritabilis ſuper terribili eſmeuta paiſanarium de Cuellis*, among the French. The famous Rabelais firſt transferred the *macaronic* ſtyle out of the Italian verſe into French proſe; and on the model thereof formed ſome of the beſt things in his *Pantagrel*. We have little in Engliſh in the *macaronian* way; nothing ſcarce, but ſome little looſe pieces collected in Camden's remains. But the Germans and Netherlanders have had their *macaronic* poets; witneſs the *Ceriamen Catholicum cum Calviniſtis*, of one Martinius Hamconius Friſius, which contains about 1200 verſes, all the words whereof begin with the letter C.

MACARSKA, a town of Dalmatia, and capital of Primogria, with a pretty good harbour, and a biſhop's ſee, ſeated on the gulph of Venice. E. Long. 17. 57. N. Lat. 43. 42.

MACASSAR, a conſiderable kingdom of the iſland of Celebes, in the Eaſt Indies. The climate is very hot; and would be intolerable, were it not for the rains which fall when the ſun is directly over their heads. The ſoil is extremely fertile, and there are ripe fruits at all times of the year. There are great numbers of monkies, who are devoured by monſtrous ſerpents; ſome of which are ſo large, that they will ſwallow one of theſe animals entire. The Macaſſars are large, robuſt, courageous, and greatly addicted to war. They profeſs the Mahometan religion.

Macassar, a large, ſtrong, and handſome town of the iſland of Celebes, and capital of the kingdom of the iſland of Celebes, where the king reſides. The houſes are all built of wood, and ſupported by thick poſts; and they have ladders to go up into them, which they draw up as ſoon as they have entered. The roofs are covered with very large leaves, which prevent the rain from entering. It is ſeated near the mouth of a large river, which runs through the kingdom from north to ſouth. E. Lon. 117. 55. S. Lat. 5. 0.

Macassar Poiſon, in natural hiſtory, called *ippo* in the Macaſſar and Malayan tongue, is the gum of a certain tree, ſhining, brittle, black, and every way like ſtone-pitch, growing in the iſland of Celebes, in the South Seas; with which all the natives arm themſelves in travel, having a long hollow trunk of a hard red wood like braſil, accurately bored, and at one end is fixed a large lance-blade of iron. Then they make a ſmall arrow, very ſtraight, and ſomewhat bigger than a large wheaten ſtraw: at one end they fix it into a round piece of white, light, ſoft, wood, like cork, about the length of the little finger, juſt fit for the bore of the trunk, to paſs clear by the force of one's breath, and to fill it ſo exactly, that the air may not paſs by, but againſt it, in order to carry it with the greater force. At the other end they fix in it either a ſmall fiſh-tooth for that purpoſe, or make a blade of wood of the bigneſs of the point of a lancet, about three-quarters of an inch long, and making a little notch in the end of the arrow, they ſtrike it firm therein, which they anoint with poiſon. The poiſonous gum, when gathered, is put into hollow bamboos or canes, ſtopped up very cloſe, and thus brought to Macaſſar. When they fit it for uſe, they take a piece of ſmooth turtle-ſhell, and a ſtick cut flat and ſmooth at the end: then they take green galengal root, grate it, and with the addition of a little fair water, preſs the juice into a clean china diſh: then with a knife ſcraping a little of the poiſon upon the ſhell, dip the end of the ſtick in the forementioned liquor, and with this diſſolve the poiſon to the conſiſtence of a ſyrup: when this is done, they anoint the fiſh-tooth or wooden blade with the ſame ſtick, and lay it in the ſun, ſo that it may be baked hard. The pointed arrows thus prepared, are put in hollow bamboos, cloſe ſhut, and in this ſtate they retain their virtue for a month.

MACCABÆUS (Judas). See Judas.

MACCABEES, two apocryphal books of ſcripture, containing the hiſtory of Judas and his brothers, and their wars againſt the Syrian kings in defence of their religion and liberties, ſo called from Judas Mattathias, ſurnamed *Maccabeus*, as ſome ſay from the word מכבי, formed of the initials of מי כמכה באלם יהוה, q. d. *Who is like unto thee, O Lord, among the Gods*; which was the motto of his ſtandard; whence thoſe who fought under his ſtandard were called *Maccabees*, and the name was generally applied to all who ſuffered in the cauſe of the true religion, under the Egyptian or Syrian kings. The firſt book of the Maccabees is an excellent hiſtory, and comes neareſt to the ſtyle and manner of the ſacred hiſtorians of any extant. It was written originally in the Chaldee language. Of the Jeruſalem dialect, and was extant in this language in the time of Jerom. From the Chaldee it was tranſlated into Greek, from the Greek into Latin. It is ſuppoſed to have been written by John Hyrcanus the ſon of Simon, who was prince and high prieſt of the Jews near 30 years, and began his government at the time where this hiſtory ends. It contains the hiſtory of 40 years, from the reign of Antiochus Epiphanes to the death of Simon the high prieſt; that is from the year of the world 3829 to the year 3869; 131 years before Chriſt. The ſecond book of the Maccabees begins with two epiſtles ſent from the Jews of Jeruſalem to the Jews of Egypt and Alexandria; to exhort them to obſerve the feaſt of the dedication of the new altar erected by Judas on his purifying the temple. The firſt was written in the 169th year of the era of the Seleucidæ, *i. e.* before Chriſt 144; and the ſecond in the 188th year of the ſame era, or 125 before Chriſt; and both appear to be ſpurious. After theſe epiſtles follows the preface of the author to his hiſtory, which is an abridgement of a larger work, compoſed by one Jaſon, a Jew of Cyrene, who wrote in Greek the hiſtory of Judas Maccabeus and his brethren, and the wars againſt Antiochus Epiphanes, and Eupator his ſon. This ſecond book does not by any means equal the accuracy and excellency of the firſt. It contains a hiſtory of about 15 years, from the execution of Heliodorus's commiſſion, who was ſent by Seleucus to fetch away the treaſures of the temple, to the victory obtained by Judas Maccabeus over Nicanor; that is, from the year of the world 3828, to the year 3843, 147 years before Chriſt.

There are in the Polyglot bibles, both of Paris and London, Syriac verſions of both theſe books; but they, as well as the Engliſh verſions which we have among the apocryphal writers in our Bibles, are derived from the Greek. There is alſo a third book of the Maccabees, containing the hiſtory of the perſecution of Ptolemy Philopator againſt the Jews in Egypt, and their ſufferings under it, and ſeems to have been written by ſome Alexandrian Jew in the Greek language, not long after the time of Siracides. It is in moſt of the ancient manuſcript copies of the Greek Septuagint, particularly in the Alexandrian and Vatican, but was never inſerted into the vulgar Latin verſion of the Bible, nor conſequently into any of the Engliſh copies. Moreover, Joſephus's hiſtory of the martyrs that ſuffered under Antiochus Epiphanes, is found in ſome manuſcript Greek Bibles, under the name of the fourth book of the *Maccabees*.

MACBETH, a Scots nobleman in the 11th century, nearly allied to Duncan king of Scotland.—Not contented with curbing the king's authority, he carried his peſtilent ambition ſo far as to put him to death; and, chaſing Malcolm Kenmure his ſon and heir into England, uſurped the crown. Siward earl of Northumberland, whoſe daughter Duncan had married, undertook, by the order of Edward the Confeſſor the protection of the fugitive prince.—He marched with an army into Scotland; defeated and killed Macbeth; and reſtored Malcolm to the throne of his anceſtors. Shakeſpeare has made this tranſaction the ſubject of one of his beſt tragedies.

MACBRIDE (Dr David) an eminent phyſician and philoſopher, was deſcended from an ancient family in the county of Galloway in Scotland. His grandfather, a clergyman, had ſettled in Ireland about the end of the laſt century, as miniſter to a Preſbyterian congregation at Belfaſt; and his father, who followed the ſame line, was ſettled at Ballymony in the county of Antrim, where he married, and where our author was born in April 1726. After a proper ſchool-education, and having paſſed ſome time under the tuition of an eminent ſurgeon in his native place, he was ſent to the univerſity of Glaſgow. Having there completed the uſual courſe of academical ſtudies, he came to Edinburgh for the further proſecution of medical ſcience. After a ſhort ſtay here, a war then prevailing between France and Britain, he was induced to go on board the navy in the ſtation of a ſurgeon's mate. In the ſervice of his country he continued for ſeveral years; and after diſcharging for ſome time the duties of an aſſiſtant, he was raiſed to the rank of ſurgeon. In this ſituation, he firſt turned his thoughts towards the diſcovery of a remedy for the ſea-ſcurvy. It was not, however, at this period, that either chance or reaſoning ſuggeſted to him the employment of an article which has ſince been attended with the moſt beneficial conſequences. Here he had an opportunity only of obſerving the ſymptoms, of ſtudying the nature, and of lamenting the conſequences, of the diſeaſe.

The termination of the war by the peace of Aix-la-Chapelle put a period to Dr Macbride's employment as a naval ſurgeon. He had now probably obtained much medical knowledge in the ſchool of experience; but he was ſenſible that he had ſtill much to acquire in that of ſcience. An ardent keenneſs to mingle in active life had led him from the ſchools of medicine at an earlier period than could have been wiſhed; and an earneſt deſire to found his future practice in the beſt eſtabliſhed principles led him back to them, when a judgment, matured by years, and informed from the obſervation of facts, rendered him capable of hearing teachers with greater advantage. He returned therefore to Edinburgh, and again entered on the career of academical purſuits, under the tuition of Dr Monro, and theſe other teachers, whoſe abilities raiſed the fame of the medical ſchool at this place. But not ſatisfied with the inſtructions to be had from any one ſet of profeſſors, the celebrity of the medical teachers in London led him alſo to viſit that capital. There he particularly became the pupil of thoſe diſtinguiſhed lecturers, Dr Hunter and Dr Smellie. And while from the former he laboured to acquire an accurate chirurgical knowledge, from the latter he endeavoured to obtain the true principles of midwifery conſidered as a ſcience. At the ſame time, he was no leſs induſtrious in improving himſelf in the ſucceſsful practice of both arts by attention at hoſpitals.

Thus prepared for the exerciſe of his profeſſion, about the end of the year 1749 he fixed his reſidence in Dublin in the character of ſurgeon and accoucheur. If amiable manners, and extenſive knowledge of his profeſſion, could alone have been ſufficient introductions to practice, he might in a ſhort time have looked for a competent ſhare of buſineſs in that capital: but while he had to combat that objection which very generally ariſes from youth, his progreſs was alſo not a little retarded by an uncommon degree of modeſty Hence for ſeveral years he remained almoſt in a ſtate of obſcurity, and was employed by but few people either of rank or fortune. But, if it is to be regretted that for many years his time was not ſo fully employed in the lucrative part of his profeſſion as was due to his merit it ought ſtill to be remembered, that this eſſentially promoted the cauſe of ſcience; for by this means his genius and induſtry were directed to medical reſearches; and were productive of diſcoveries which will with honour tranſmit his name to lateſt poſterity. Theſe, though ſome of them might have been ſucceſsfully turned to his own emolument, were freely communicated to the world in different publications; and he did not ſhow greater ingenuity in making diſcoveries, than liberality of ſentiment in publiſhing them for the advantage of others.—His firſt publication intitled, "Experimental Eſſays on Medical and Philoſophical Subjects," made its appearance in the year 1764.—Theſe Eſſays are five in number: 1. On the fermentation of alimentary mixture and the digeſtion of the food. 2. On the nature and properties of fixed air. 3. On the different kinds of antiſeptics. 4. Of the diſſolvent power of quicklime. 5. Of the ſea-ſcurvy. The merit of all theſe is ſufficiently known and acknowledged: but the laſt of them is unqueſtionably the moſt important; the method therein propoſed of both the prevention and cure of that dreadful diſeaſe the ſcurvy, having been confirmed by repeated and undeniable obſervation.

Having thus equally diſtinguiſhed himſelf as an ingenious philoſopher and able practitioner, the world were not now ſlow in beſtowing upon him the tribute of applauſe to which he was intitled. His name was enrolled with honour in the liſts of many learned ſocieties; and the univerſity where his ſtudies had firſt been commenced, were proud to confer upon him the degree of Dr of Medicine.

The reputation, however, of being a diſtinguiſhed author, was to him but a ſecondary object; and his talents were not confined to the advancement of medicine alone. Having ſucceſsfully diſcovered a conſiderable improvement in the art of tanning, with that ſpirited generoſity which is ever the concomitant of real worth, he ſpeedily and freely communicated it to the public, by publiſhing, firſt, "An Account of a New Method of Tanning;" and afterwards, "Inſtructions for carrying on the New Method of Tanning." As a mark of approbation for this liberal conduct, as well as a teſtimony of reſpect for his ingenuity, prize-medals were conferred upon him by the Societies of Arts both in London and Dublin. But his laſt and moſt extenſive publication was more immediately in the line of his own profeſſion; It is intitled, "A Methodical Introduction to the Theory and Practice of Medicine." In that valuable work he has given a conciſe and connected view of the principles and practice of the healing art, as beſt eſtabliſhed by ſound reaſon, and confirmed by accurate obſervation. Moſt if not all of theſe publications, not only went through various editions, but were tranſlated into different languages.

After the merit of Dr Macbride came to be properly known, the public ſeemed to ſhow a deſire of making compenſation for having ſo long overlooked it. His employment increaſed ſo rapidly, that he had more buſineſs than he could tranſact either with eaſe or ſafety. This having kept him in perpetual agitation both of body and mind, at laſt induced an almoſt total incapacity of ſleeping. From this circumſtance his health could not fail to be impaired. In this ſituation, after accidental expoſure to cold, he was attacked with a fever, which put an end to his life on the 13th of December 1778, in the 53d year of his age.

Thoſe who were his moſt intimate acquantance were inclined to believe that his death was not a little haſtened by domeſtic calamities. During his reſidence in Dublin he was twice married, and was as often ſubjected to that inexpreſſible diſtreſs which muſt reſult from a final ſeparation in this world from the moſt intimate and loving friends. By both of his wives he had ſeveral children, but none of them ſurvived their father. And on theſe calamitous events, although he was able to conceal his feelings from the world, yet they gave a ſevere ſhock to his conſtitution. After his death, ſeveral of the playful trinkets of his infants with the ſignature of *dulces exuviæ*, were found in his repoſitories among papers on medical and other important ſubjects; an incontrovertible proof, that in him at leaſt, the great mind of the philoſopher was conjoined with the feeling heart of the affectionate father. But if his abilities were remarkable as a philoſopher and phyſician, if his conduct was exemplary as an huſband and parent, his manners were no leſs amiable as a companion and friend. His polite and benevolent conduct, joined to his taſte for the fine arts, conciliated the affections and eſteem of all who knew him. His death was univerſally and ſincerely lamented in the city of Dublin.

MACCLESFIELD, a town of Cheſhire in England, 17 miles from London, is ſeated on the edge of a foreſt of the ſame name, upon a high bank near the river Bollin; and is a large handſome town, with a fine church and a very high ſteeple. It was erected into a borough by King Edward III. is governed by a mayor, and enjoys great privileges and juriſdictions by virtue of the court and the liberties of the foreſt. In its church are two braſs plates, on one of which there is a promiſe of 26,000 years and 26 days pardon for ſaying five Pater-Noſters and five Aves. Its chief manufacture is mohair buttons. The market is on Mondays; the fairs are June 11 and 30, and Nov. 2. In Macclesfield foreſt are many pits dug for the ſake of the turf; in which it is common to ſee fir-trees buried, which are dug up for various uſes, but chiefly for ſplinters that ſerve the poor for candles. W. Long. 2. 10. N. Lat. 53. 15.

MACE, an ancient weapon, formerly much uſed by the cavalry of all nations. It was commonly made of iron; its figure much reſembles a chocolate mill; many ſpecimens may be ſeen in the Tower. It was with one of theſe that Walworth mayor of London knocked the rebel Wat Tyler from off his horſe in Smithfield for approaching the young king Richard II. in an inſolent manner; and as he fell, he diſpatched him with his dagger. The mace in modern times changed its form; and being no longer a war inſtrument, is made of copper or ſilver gilt, ornamented with a crown, globe, and croſs, and is now the chief inſignia of authority throughout Great Britain. Similar to the ancient maces, were thoſe ſtaves at the end of which iron or leaden balls armed with ſpikes were ſuſpended by chains: they were till lately carried by the pioneers of the trained-bands or city militia.

MACE, in the materia medica, the ſecond coat of covering of the kernel of the nutmeg, is a thin and membranaceous ſubſtance, of an oleaginous nature, and a yellowiſh colour; being met with in flakes of an inch or more in length, which are divided into a multitude of ramifications. It is of an extremely fragrant, aromatic, and agreeable flavour; and of a pleaſant, but acrid oleaginous taſte.

Mace is carminative, ſtomachic, and aſtringent; and poſſeſſes all the virtues of nutmeg, but has leſs aſtringency.—The oils of mace and nutmeg, whether prepared by diſtillation or expreſſion, are ſo much of the ſame nature, that they may be indiſcriminately uſed for one another on all occaſions. They give eaſe in cholics, and often in nephritic caſes, taken internally from one drop to five or ſix of the diſtilled oil, or an equal quantity of the expreſſed; and externally, they are of uſe to rub paralytic limbs: they alſo aſſiſt digeſtion; and will often ſtop vomitings and hiccoughs, only by being rubbed on the region of the ſtomach. The nurſes have a cuſtom of applying oil of mace by expreſſion to childrens navels to eaſe their gripes, and that often with ſucceſs; and we are aſſured, by authors of credit, that when rubbed on the temples, it promotes ſleep.

MACEDON, or MACEDONIA, a moſt celebrated kingdom of antiquity, was bounded on the eaſt by the Ægean ſea; on the ſouth by Theſſaly and Epirus; on the weſt by the Ionian ſea or Adriatic; on the north, at firſt by the river Strymon and the Scardian mountains, but afterwards by the river Neſſus or Neſtus. In a direct line the whole country extended only 150 miles in length; but the windings of the coaſt lengthened it out to three times that extent; in which almoſt every convenient ſituation was occupied by a Grecian ſea-port. The country was naturally divided by the Thermaic and Strymonic gulphs, into the provinces of Pieria, Chalcis, and Pangæus. The middle region, which took its name from a city of Euboea from whence it was originally peopled, was very fertile and pleaſant; the inland country, being diverſified by lakes, rivers, and arms of the ſea, was extremely convenient for inland navigation, while the towns of Amphipolis, Potidæa, Acanthus, and many others, afforded marts for the commerce of the republics of Greece, as well as of Thrace and Macedon. On one ſide of this diſtrict were the mountains of Pangæus, and on the other the plains of Pieria. The Pangæan

1
Situation, &c. of the country.

mountains, which extended 90 miles towards the eaſt and the river Neſſus, though proper neither for corn nor paſture, produced plenty of timber for ſhip-building; while the ſouthern branches of the mountain contained rich veins of gold and ſilver; but theſe, though wrought ſucceſſively by the Thaſians and the Athenians, were only brought to perfection by Philip of Macedon, who extracted from them gold and ſilver to the value of 200,000l. Sterling annually. Pieria extended 50 miles along the Thermaic gulph, to the confines of Theſſaly and mount Pindus. The inland part of the country was beautifully diverſified with ſhady hills and fountains; and ſo admirably calculated for ſolitary walks and retirement, that the ancients looked upon it to be the favourite haunt of the muſes, and accordingly beſtowed upon them the title of *Pierides*.

2 Different names.

In the moſt early times this country was called *Æmathia*, from *Æmathius* one of its princes. The name of *Macedon* is ſaid to have been derived from *Maſedo* a deſcendant of Deucalion; though others ſuppoſe it to have been only a corruption of *Mygdonia* a diſtrict of the country. In thoſe remote ages of antiquity, Macedon, like moſt other countries of Europe, was divided into a great number of petty principalities, of which ſcarce even the names are known at this time. All authors agree, however, that *Caranus* was the firſt who eſtabliſhed any permanent ſovereignty in Macedon.

3 Kingdom founded by Caranus.

He was an Argive, a deſcendant of Hercules, and about 800 years B. C. conducted a ſmall colony of his countrymen into the inland diſtrict of Macedon at that time diſtinguiſhed by the name of *Æmathia* as already mentioned. This territory was about 300 miles in circumference. On the ſouth it was ſeparated from the ſea by a number of Greek republics, of which the moſt conſiderable were thoſe of Olynthus and Amphipolis; and on the north, eaſt, and weſt, was ſurrounded by the barbarous kingdoms of Thrace, Pœonia, and Illyricum. According to the traditions of thoſe times, Caranus, having conſulted the oracle on the ſucceſs of his intended expedition, was commanded to be directed by the goats in the eſtabliſhment of his empire. For ſome time he proceeded at random, without knowing what to make of the oracle's anſwer; but happening to enter the ſmall kingdom of *Æmathia*, at that time governed by King Midas, he obſerved a herd of goats running towards *Edeſſa* the capital. Recollecting then the anſwer of the oracle, he attacked and took the city by ſurpriſe, ſoon after making himſelf maſter of the whole kingdom. In memory of this remarkable event he called the city *Ægea*, and the people *Ægiates*, from the goats who conducted him, and made uſe of the figure of a goat in his ſtandard. From this fable alſo we ſee why the figure of a goat is ſo frequently ſeen on the coins of Philip and his ſucceſſors.

4 Policy of this prince.

The little colony of Argives led into Æmathia by Caranus would ſoon have been overwhelmed by the barbarous nations who ſurrounded it, had not this prince and his ſubjects taken care to ingratiate themſelves with their neighbours, rather than to attempt to ſubdue them by force of arms. They inſtructed them in the Grecian religion and government, and in the knowledge of many uſeful arts; adopting themſelves, in ſome degree, the language and manners of the barbarians; imparting to them in return ſome part of the Grecian civilization and polite behaviour. Thus they gradually aſſociated with the fierce and warlike tribes in their neighbourhood; and this prudent conduct, being followed by ſucceeding generations, may be looked upon as one of the cauſes of the Macedonian greatneſs.

5 Perdiccas I. a celebrated monarch.

6 Invaſion by the Illyrians.

Caranus, dying after a reign of three years, left the kingdom to his ſon Cœnus; who having conſiderably enlarged his dominions, was ſucceeded by Thurymas, and he by Perdiccas I. This laſt prince is by Thucydides and Herodotus accounted the founder of the Macedonian monarchy; though his hiſtory is ſo obſcured by fable, that nothing certain can now be known concerning it. In proceſs of time, however, the good underſtanding which had ſubſiſted between the Macedonians and their barbarous neighbours began to ſuffer an interruption; and in 691 B. C. the kingdom was for the firſt time invaded by the Illyrians. At firſt they did conſiderable damage by their ravages; but the Macedonian monarch, Argæus, having decoyed them into an ambuſh, cut off great numbers, and obliged the remainder to leave the kingdom. In the reign of his ſucceſſors, however, they returned, and occaſionally proved very troubleſome enemies till the reigns of Philip and Alexander.

7 Interference of the Perſians and Macedonians.

In the mean time the kingdom of Macedon began to be affected by thoſe great events which took place in other parts of the world. Cyrus having overthrown the Babylonian empire, and conquered all the weſtern part of Aſia, eſtabliſhed a mighty monarchy, which threatened all the eaſtern parts of Europe with ſubjection. The Greeks, however, having now emerged from their barbariſm, and acquired great knowledge in the art of war, were able to reſiſt effectually this very formidable power; but the kingdom of Macedon, obſcure and unconnected, was obliged to yield, and though not formally made a province of the Perſian empire, was nevertheleſs accounted in ſome ſort as under the vaſſalage and protection of the Perſians. Alcetas, who aſcended the Macedonian throne about the time that the Perſian monarchy was founded, had the dexterity to preſerve his dominions from the encroachments of the Greeks on the one hand, and of the Perſians on the other; but in the reign of his ſucceſſor Amyntas a formal demand was made of ſubmiſſion to the great King Darius, by ſending him a preſent of earth and water. Seven ambaſſadors were ſent on this errand by Megabizus, one of the officers of Darius. They were ſumptuouſly entertained by Amyntas; but having attempted to take ſome indecent liberties with the Macedonian women, Alexander the king's ſon cauſed them all to be murdered. This raſh action had had almoſt proved the ruin of the kingdom; but Alexander found means to pacify Bubaris the general ſent againſt him by Megabizus, by ſhowing him his ſiſter Hygæa, a very beautiful woman, with whom the Perſian fell in love at firſt ſight, and afterwards married her.

8 Advantages accruing to Macedon from this interference.

From this time the Macedonians were accounted the faithful allies of the Perſians; and, through the intereſt of his ſon-in law, Amyntas obtained the country in the neighbourhood of mount Hæmus and Olympus, at the ſame time that the city of Alabanda in Phrygia was given to Amyntas the nephew of Alexander. The Macedonians diſtinguiſhed themſelves in the time of of the Perſian invaſion of Greece, by furniſhing their allies with 200,000 recruits; though ſome cities, particularly Potidæa, Olynthus, and Pallene, adhered to the Grecian intereſt. The two laſt were taken and raſed, and the inhabitants maſſacred by the Perſians; but Potidæa eſcaped by reaſon of the ſea breaking into the Perſian camp, where it did great damage. Alexander, however, afterwards thought proper to court the favour of the Greeks by giving them intelligence of the time when Mardonius deſigned to attack them. The remaining tranſactions of this reign are entirely unknown, farther than that he enlarged his dominions to the river Neſſus on the eaſt and the Axius on the weſt.

9 Reign of Perdiccas II.

Alexander I. was ſucceeded by his ſon Perdiccas II. who according to Dr Gillies, "inherited his father's abilities, though not his integrity." But from his duplicity abovementioned both to Greeks and Perſians, it does not appear that he had much to boaſt of as to the latter quality. In the Peloponeſian war he eſpouſed the cauſe of the Spartans againſt the Athenians, from whom he was in danger by reaſon of their numerous ſettlements on the Macedonian coaſt, and their great power by ſea. For ſome time, however, he amuſed the Athenians with a ſhow of friendſhip; but at laſt, under pretence of enabling Olynthus and ſome other cities to recover their liberties, he aſſiſted in deſtroying the influence of the Athenians in thoſe places, in hopes of eſtabliſhing that of the Macedonians in its ſtead. But this deſign failed of ſucceſs; the Olynthian confederacy was broken, and the members of it became ſubject to Sparta, until at laſt, by the misfortunes of that republic, they became ſufficiently powerful not only to reſiſt the encroachments of the Macedonians, but to make conſiderable conqueſts in their country.

10 Of Archelaus I.

Perdiccas II. was ſucceeded about 416 B. C. by Archelaus I. He enlarged his dominions by the conqueſt of Pydna, and other places in Pieria, though his ambition ſeems rather to have been to improve his dominions than greatly to extend them. He facilitated the communication between the principal towns of Macedon, by cutting ſtraight roads through moſt part of the country: he built walls and fortreſſes in ſuch places as afforded a favourable ſituation; encouraged agriculture and the arts, particularly thoſe ſubſervient to war; formed magazines of arms; raiſed and diſciplined a conſiderable body of cavalry; and in a word, ſays Dr Gillies, added more to the ſolid grandeur of Macedon than had been done by all his predeceſſors put together. Nor was he regardleſs of the arts of peace. His palace was adorned by the works of Grecian painters. Euripides was long entertained at his court; Socrates was earneſtly ſolicited to live there, after the example of this philoſophic poet, formed by his precepts and cheriſhed by his friendſhip: men of merit and genius in the various walks of literature and ſcience we invited to reſide in Macedon, and treated with diſtinguiſhed regard by a monarch duly attentive to promote his own glory and the happineſs of his ſubjects."

11 The kingdom becomes a prey to civil diſſenſions.

This great monarch died after a reign of ſix years, a ſpace by far too ſhort to accompliſh the magnificent projects he had formed. After his death the kingdom fell under the power of uſurpers or weak and wicked monarchs. A number of competitors conſtantly appeared for the throne; and theſe by turns called in to their aſſiſtance the Thracians, Illyrians, Theſſalians; the Olynthian confederacy, Athens, Sparta, and Thebes. Bardyllis, an active and daring chief, who, from being head of a gang of robbers, had become ſovereign of the Illyrians, entered Macedon at the head of a numerous army, depoſed Amyntas II. the father of Philip, and ſet up in his place one Argæus, who conſented to become tributary to the Illyrians. Another candidate for the throne, named *Pauſanias*, was ſupported by the Thracians, but, by the aſſiſtance of the Theſſalians and Olynthians, Amyntas was enabled to reſume the government. After his reſtoration, however, the Olynthians refuſed to deliver up ſeveral places of importance belonging to Macedon which Amyntas had either entruſted to their care, or which they had taken from his antagoniſt.

12 War with the Olynthians.

Amyntas complained to Sparta; and that republic, which had already formed ſchemes of very extenſive ambition, ſo readily complied with the requeſt, that it was generally ſuppoſed to have proceeded from Spartan emiſſaries ſent into Macedonia. They pretended indeed to heſitate a little, and to take time to deliberate on the army which ought to be raiſed for the purpoſe; but Cleigenes, the principal ambaſſador, repreſented the urgency of the caſe in ſuch a manner, that the troops which happened at that time to be ready were ordered to take the field without delay. Two thouſand Spartans, under the command of Eudamidas were ordered into Macedon, while a powerful reinforcement under the command of Phœbidas, brother to the general, was ordered to follow him as ſoon as poſſible. By accident, Phœbidas and his auxiliaries were detained till the ſeaſon for action was paſſed; but Eudamidas with his ſmall army performed very eſſential ſervice. The appearance of a Spartan army at once encouraged the ſubjects and allies of the Olynthians to revolt; and the city of Potidæa, a place of great importance in the iſthmus of Pallene, ſurrendered ſoon after his arrival in the country. Being too much elated with his ſucceſs, however, Eudamidas approached ſo near the city of Olynthus, that he was unexpectedly attacked, defeated and killed in a ſally of the citizens. He was ſucceeded by Teleutias the brother of Ageſilaus, who had under his command a body of 10,000 men, and was farther aſſiſted by Amyntas king of Macedon and Derdas his brother, the governor or ſovereign of the moſt weſterly province of Macedon, which abounded in cavalry. By theſe formidable enemies the Olynthians were defeated in a number of battles, obliged to ſhut themſelves up in their city, and prevented from cultivating their territory; on which Teleutias advanced with his whole forces to inveſt the city itſelf. His exceſſive eagerneſs to deſtroy his enemies proved his ruin. A body of Olynthian horſe had the boldneſs to paſs the river Amnias in ſight of the allied army, though ſo much ſuperior in number. Teleutias ordered his targeteers to attack them, the Olynthians, having retreated acroſs the river, were cloſely purſued by the Lacedemonians, great part of whom alſo paſſed the river; but the Olynthians ſuddenly turning upon them, killed upwards of 100, with Tlemondas their leader. Teleutias, exaſperated at this diſaſter, ordered the remainder of the targeteers and cavalry to purſue ; while he himſelf advanced at the head of the heavy armed foot with ſuch celerity that they began to fall into diſorder. The Olynthians allowed them to proceed, and the Lacedæmonians very imprudently advanced juſt under the towers and battlements of the city. The townſmen then mounted the walls, and diſcharged upon them a ſhower of darts, arrows, and other miſſile weapons, while the flower of the Olynthian troops, who had been purpoſely poſted behind the gates, ſallied forth and attacked them with great violence. Teleutias attempting to rally his men, was ſlain in the firſt onſet ; the Spartans who attended him were defeated, and the whole army at laſt diſperſed with great ſlaughter, and obliged to ſhelter themſelves in the towns of Acanthus, Apollonia, Spartolus, and Potidæa.

13
The Olynthians obliged to ſubmit.

14
Pella made the capital of Macedon.

The Spartans, undiſmayed by this terrible diſaſter, next ſent their King Ageſipolis with a powerful reinforcement into Macedon. His preſence greatly raiſed the ſpirits of the Lacedæmonian allies, and his rapid ſucceſs ſeemed to promiſe a ſpeedy termination to the war, when he himſelf died of a calenture. He was ſucceeded in the throne by his brother Cleombrotus, and in the command of the army by Polybiades an experienced general, who likewiſe brought along with him a powerful reinforcement. Olynthus was now completely blocked up by land, while a ſquadron of Lacedæmonian galleys blocked up the neighbouring harbour of Myceberna. The Olynthians, however, held out for nine or ten months, but at laſt were obliged to ſubmit on very humiliating conditions. They formally renounced all claim to the dominion of Chalcis; they ceded the Macedonian cities to their ancient governor ; and in conſequence of this Amyntas left the city of Ægæa or Edeſſa, where till now he had held his royal reſidence, and fixed it at Pella, a city of great ſtrength and beauty, ſituated on an eminence, which together with a plain of conſiderable extent was defended by impaſſible moraſſes, and by the rivers Axius and Lydias. It was diſtant about 15 miles from the Ægean ſea, with which it communicated by means of the abovementioned rivers. It was originally founded by the Greeks, who had lately conquered and peopled it ; but in conſequence of the misfortunes of Olynthus, it now became the capital of Macedon, and continued ever after to be ſo.

15
Pauſanias uſurps the throne.

16
Ptolemy aſpires to the throne.

17
The Macedonians defeated, and their king killed by the Illyrians.

Amyntas, thus fully eſtabliſhed in his dominions, continued to enjoy tranquillity during the remaining part of his life. The reign of his ſon Alexander was ſhort, and diſturbed by invaſions of the Illyrians; from whom he was obliged to purchaſe a peace. He left behind him two brothers, Perdiccas and Philip, both very young ; ſo that Pauſanias again found means to uſurp the throne, being ſupported not only by the Thracians, but a conſiderable number of Greek mercenaries, as well as a powerful party in Macedon itſelf. In this critical juncture, however, Iphicrates the Athenian happening to be on an expedition to Amphipolis, was addreſſed by Eurydice the widow of Amyntas, ſo warmly in behalf of her two ſons, whom ſhe preſented to him, that he intereſted himſelf in their behalf, and got Perdiccas the eldeſt eſtabliſhed on the throne. He was induced alſo to this piece of generoſity by the kindneſs which Eurydice and her huſband had formerly ſhown to himſelf, and he likewiſe ſaw the advantages which muſt enſue to his country from a connection with Macedon. During the minority of the young prince, however, his brother Ptolemy, who was his guardian, openly aſpired to the throne; but he was depoſed by the Theban general Pelopidas, who reinſtated Perdiccas in his dominions; and in order to ſecure, in the moſt effectual manner, the dependence of Macedon upon Thebes, carried along with him thirty Macedonian youths as hoſtages ; and among them Philip, the younger brother of the king. Perdiccas now, elated by the protection of ſuch powerful allies, forgot Iphicrates and the Athenians, and even diſputed with them the right to the city of Amphipolis, which had been decreed to them by the general council of Greece, but which his oppoſition rendered impoſſible for them to recover. In conſequence of the truſt he put in theſe new allies, alſo, it is probable that he refuſed to Bardyllis the Illyrian the tribute which the Macedonians had been obliged to pay him ; which occaſioned a war with that nation. In this conteſt the Macedonians were defeated with the loſs of 4000 men, Perdiccas himſelf being taken priſoner, and dying ſoon after of his wounds.

The kingdom was now left in the moſt deplorable ſtate. Amyntas, the proper heir to the throne, was an infant; the Thebans, in whom Perdiccas had placed ſo much confidence, were deprived of the ſovereignty of Greece; the Athenians, juſtly provoked at the ungrateful behaviour of the late monarch, ſhowed an hoſtile diſpoſition ; the Illyrians ravaged the weſt, and the Pæonians the north quarter of the kingdom ; the Thracians ſtill ſupported the cauſe of Pauſanias, and propoſed to ſend him into Macedon at the head of a numerous army; while Argæus, the formal rival of Amyntas, renewed his pretenſions to the throne, and by flattering the Athenians with the hopes of recovering Amphipolis, eaſily induced them to ſupport his claims ; and in conſequence of this they fitted out a fleet, having on board 3000 heavy armed ſoldiers, which they ſent to the coaſt of Macedon.

18
Philip arrives in Macedon.

Philip, the late king's brother, no ſooner heard of his defeat and death, than he ſet out privately from Thebes ; and on his arrival in Macedon found matters in the ſituation we have juſt now deſcribed. Fired with an inſatiable ambition, it is very probable that from the very firſt moment he had reſolved to ſeize the kingdom for himſelf ; yet it was neceſſary at firſt to pretend that he aſſumed the throne only to preſerve it for his nephew. Philip, as has already been mentioned, was carried off as an hoſtage by Pelopidas, but for a long time paſt had remained in ſuch obſcurity, that hiſtorians diſagree as to his place of reſidence ; ſome placing him in Thebes, and others in Macedon. It is certain, however, that from the age of 15 he had been very much in the family of Epaminondas, from whoſe leſſons he could not but derive the greateſt emolument. It is probable alſo that he attended this celebrated general in many of his expeditions ; and it is certain, that, with an attendance ſubtable to his rank, he viſited moſt of the principal republics, and ſhowed an attention to their inſtitutions, both civil and military, far ſuperior to his years. Having eaſy acceſs to whomſoever he pleaſed, he cultivated the friendſhip of the firſt people in Greece. Even in Athens, where

where no good-will ſubſiſted with Macedon, the philoſophers Plato, Iſocrates, and Ariſtotle, cultivated his acquaintance; and the connection he formed with the principal leaders of that republic in the early period of his life, no doubt contributed greatly to the accompliſhment of the deſigns in which he afterwards proved ſo ſucceſsful

19
Retrieves the affairs of the kingdom.

His appearance in Macedon inſtantly changed the face of affairs: the Macedonian army, though defeated, was not entirely deſtroyed; and the remainder of them ſecured themſelves in the fortreſſes which had been built by Archelaus. There were alſo conſiderable garriſons in the fortreſſes, and walled towns ſcattered over the kingdom; and the Illyrians, who had made war only for the ſake of plunder, ſoon returned home to enjoy the fruits of their victory. His other enemies, the Thracians and Pæonians, were much leſs formidable than the Illyrians, being ſtill in a very rude and uncivilized ſtate, incapable of uniting under one head in ſuch a manner as to bring any formidable army into the field. While the Illyrians therefore gave up the campaign through mere caprice and unſteadineſs, Philip himſelf applied to the Pæonians, and by fair promiſes and flattery prevailed upon them to deſiſt. The king of Thrace, by means of a ſum of money, was eaſily prevailed upon to abandon the cauſe of Pauſanias; ſo that Philip, freed from theſe barbarians, was now left at liberty to oppoſe the Athenians, who ſupported Argæus; and threatened a very formidable invaſion.

The appearance of the Athenian fleet before Methone, with that of Argæus at the head of a numerous army in Pieria, filled the whole country with conſternation; and Philip, who was by no means deficient in talents neceſſary to recommend himſelf to the good graces of the people, took the opportunity of getting Amyntas ſet aſide, and himſelf declared king; for which indeed the danger of the times afforded a very plauſible pretext.

20
Takes upon him the ſovereignty,

Argæus, in the mean time, advanced with his Athenian allies towards Edeſſa, or Ægæ the ancient capital of the Macedonian empire, where he hoped to have been amicably received, but finding the gates ſhut againſt him, he turned back to Methone.

21
Defeats and kills Argæus an uſurper.

Philip haraſſed him in his retreat, cutting off great numbers of his men, and afterwards defeated him in a general engagement; in which Argæus himſelf, with the flower of his army, were cut in pieces, and all the reſt taken priſoners.

22
Philip's politic treatment of the priſoners.

This firſt inſtance of ſucceſs contributed greatly to raiſe the ſpirits of Philip's party; and he himſelf took care to improve it in the beſt manner poſſible. Having taken a great number of priſoners, both Macedonians and Athenians, he determined, by his treatment of them, to ingratiate himſelf with both parties. The former were called into his preſence, and, after a gentle reprimand, admitted to ſwear allegiance to him; after which they were diſtributed through the army; the Athenians were entertained at his table, diſmiſſed without ranſom, and their baggage reſtored. The priſoners were juſt allowed time to return to their native city and to ſpread abroad the news of Philip's generoſity, when they were followed by ambaſſadors from Macedon with propoſals for peace.

23
Renounces his right to Amphipolis,

As he knew that the loſs of Amphipolis had greatly irritated them, he now thought proper to renounce his juriſdiction over that city; and it was accordingly declared free and independent, and ſubject only to the goverment of its own free and equitable laws. This artful conduct, together with his kind treatment of the priſoners, ſo wrought upon the minds of the Athenians, that they conſented to the renewal of a treaty which had formerly ſubſiſted between them and his father Amyntas. Thus he found means to remove all jealouſy of his ambition or the ſchemes he might afterwards undertake to their prejudice; and not only this but to induce them to engage in a ruinous war with their allies, which occupied their attention until Philip had an opportunity of getting his matters ſo well eſtabliſhed that it was impoſſible to overthrow them.

24
Reduces the power of the nobility.

The new king being thus left at liberty to regulate his domeſtic concerns, began to circumſcribe the power of his chiefs and nobles; who, eſpecially in the more remote provinces, paid very little regard to the authority of the kings of Macedon; ſometimes, even in times of public calamity, throwing off their allegiance altogether, and aſſuming an independent goverment over conſiderable tracts of country.

25
Chooſes a number of illuſtrious young men for his companions.

To counteract the ambition of theſe chiefs, Philip choſe a body of the braveſt Macedonian youths, whom he entertained at his own table, and honoured with many teſtimonies of his friendſhip, giving them the title of his *companions* and allowing them conſtantly to attend him in war and hunting. Their intimacy with the ſovereign, which was conſidered as an indication of their merit, obliged them to ſuperior diligence in all the ſevere duties of military diſcipline, and the young nobility, eager to participate ſuch high honours, vied with each other in their endeavours to gain admiſſion into this diſtinguiſhed order; ſo that while on the one hand they ſerved as hoſtages, on the other they formed an uſeful ſeminary for future generals, by whom both Philip, and Alexander were afterwards greatly aſſiſted in their conqueſts.

26
Whether he inſtituted the phalanx.

Diodorus Siculus, and all the Roman writers who have treated of the hiſtory of Greece, aſſert that Philip, in the firſt year of his reign, inſtituted the Macdonian phalanx; a body of 6000 men armed with ſhort ſwords fitted either for cutting or ſtabbing, having alſo ſtrong bucklers four feet long and two and an half broad, and pikes 14 feet long; uſually marching 16 men deep. But this opinion is controverted by others. Dr Gillies ſuppoſes that the opinion had riſen from the Romans meeting with the phalanx in its moſt complete form in Macedon; and as they became acquainted with Greece and Macedon pretty nearly at the ſame time, it was natural for them to ſuppoſe that it had been invented among the Macedonians. The phalanx, he ſays, is nothing different from the armour and arrangement which had always prevailed among the Greeks, and which Philip adopted in their moſt perfect form; " nor is there reaſon (ſays he) to think that a prince, who knew the danger of changing what the experience of ages had approved, made any alteration in the weapons or tactics of that people. The improvement in the countermarch, to which Philip gave the appearance of advancing inſtead of retreating, mentioned by Ælian in his Tactics, c. xxviii. was borrowed, as this author tells us, from the Lacedæmonians. If Philip increaſed the phalanx, uſually leſs numerous, to 6000 men, this was far from an improvement; and the later kings of

Macedon, who ſwelled it to 16,000, only rendered that order of battle more unwieldy and inconvenient. Inſtead of this, Philip, according to our author, employed himſelf in procuring arms, horſes, and other neceſſary materials for war; and in introducing a more ſevere and exact military diſcipline than had formerly been known in Macedon.

27
Overcomes the Pæonians and Illyrians.

While the king thus took the beſt methods to render himſelf ſecure at home and formidable abroad, the Pæonians again began to make incurſions into the kingdom. The death of Agis their king, however, who was a man of great military ſkill, deprived them almoſt of every power of reſiſtance when they were attacked. Philip, of conſequence, over-ran their country with little oppoſition, and reduced them to the ſtate of tributaries to Macedon. No ſooner was this accompliſhed, then he undertook a winter's campaign againſt the Illyrians, who had long been the natural enemies of Macedon. They had now extended their territory to the eaſt; by which means the Macedonians were excluded from the harbours on the coaſt of the Adriatic. This was a grievance to Philip, who ſeems early to have meditated the raiſing of a naval power; neither could he hope to be in ſafety ſhould the kingdom be left open to the incurſions of a barbarous enemy: for which reaſons he determined at once to humble thoſe enemies in ſuch a manner that they ſhould no longer be in a ſituation to give him any diſturbance. After an ineffectual negociation, he was met by Bardyllis at the head of a conſiderable body of infantry, but with only 400 horſe. They made a gallant reſiſtance for ſome time: but being unable to cope with ſuch a ſkilful general as Philip, they were defeated with the loſs of 7000 men, among whom was their leader Bardyllis, who fell at the age of 90.

28
They are forced to become tributary.

By this diſaſter the Illyrians were ſo much diſheartened, that they ſent ambaſſadors to Philip, humbly begging for peace on any terms. The conqueror granted them the ſame conditions which had been impoſed upon the Pæonians, viz. the becoming tributary, and yielding up to him a conſiderable part of their country. That part of it which lay to the eaſtward of a lake named Lycanidus he annexed to Macedon: and probably built a town and ſettled a colony there: the country being fertile, and the lake abounding with many kinds of fiſh highly eſteemed by the ancients. This town and lake were about 50 miles diſtant from the Ionian ſea; and ſuch was the aſcendency which the arms and policy of Philip acquired over his neighbours, that the inhabitants of all the intermediate diſtrict ſoon adopted the language and manners of their conquerors; and their territory, hitherto unconnected with any foreign power, ſunk into ſuch abſolute dependence upon Macedon, that many ancient geographers ſuppoſed it to be a province of that country.

29
His great deſigns.

Philip had no ſooner reduced the Illyrians, than he began to put in execution greater deſigns than any he had yet attempted. The rich coaſts to the ſouthward of Macedon, inhabited chiefly by Greeks, preſented a ſtrong temptation to his ambition and avarice. The confederacy of Olynthus, after having thrown off the yoke of Sparta, was become more powerful than ever, and could ſend into field an army of 10,000 heavy armed troops, beſides a number of cavalry in proportion. Moſt of the towns in Chalcidice were become its allies or ſubjects; ſo that this populous and wealthy province, together with Pangæus on the right, and Pieria on the left, of both which the cities were either independent or ſubject to the Athenians, formed a barrier not only ſufficient to guard againſt any incurſions of the Macedonians, but which was even formidable to them. But though Philip was ſenſible enough of the importance of thoſe places, he conſidered the conqueſt of Amphipolis as more neceſſary at the preſent time. By the poſſeſſion of this place Macedon would be connected with the ſea, and would be ſecured in many commercial advantages, which could not but contribute greatly to the proſperity of the kingdom at large; a road was likewiſe opened to the woods and mines of Pangæus, the former of which were ſo neceſſary to the raiſing of a naval power; and the latter for the eſtabliſhment of a proper military force. This city had indeed been declared independent by Philip himſelf in the beginning of his reign; but this was only to prevent a rupture with the Athenians, who ſtill aſſerted their right to it as an ancient colony; though, by reaſon of the perfidy of Charidemus, a native of Eubœa, they had hitherto failed in their attempts to recover it. The Amphipolitans, however, having once enjoyed the ſweets of liberty, prepared to maintain themſelves in their independence. In the mean time the hoſtile deſigns of Philip, which all his precaution had not been able to conceal, alarmed the inhabitants to ſuch a degree, that they thought proper to put themſelves under the protection of the Olynthians. By them they were readily received into the confederacy; and, truſting to the ſtrength of their new allies, behaved in ſuch an inſolent manner to Philip, that he was not long of finding a ſpecious pretext for hoſtility; at which the Olynthians, greatly alarmed, ſent ambaſſadors to Athens requeſting their aſſiſtance againſt ſuch a powerful enemy. Philip, however, juſtly alarmed at ſuch a formidable conſpiracy, ſent agents to Athens, with ſuch expedition that they arrived there before any thing could be concluded with the Olynthian deputies. Having gained over the popular leaders and orators, he deceived and flattered the magiſtrates and ſenate in ſuch an artful manner, that a negociation was inſtantly ſet on foot, by which Philip engaged to conquer Amphipolis for the Athenians, upon condition that they ſurrendered to him the ſtrong fortreſs of Pydna, a place which he repreſented as of much leſs importance to them; promiſing alſo to confer upon them many other advantages, which, however, he did not ſpecify at that time. Thus the Athenians, deceived by the perfidy of their own magiſtrates, elated with the hopes of recovering Amphipolis, and outwitted by the ſuperior policy of Philip, rejected with diſdain the proffers of the Olynthians.

30
Plans the conqueſt of Amphipolis.

31
Engages to conquer it for the Athenians.

The ambaſſadors of Olynthus returned home highly diſguſted with the reception they had met with; but had ſcarce time to communicate the news to their countrymen, when the ambaſſadors of Philip arrived at Olynthus. He pretended to condole with them on the affront they had received at Athens; but teſtified his ſurpriſe that they ſhould court the aſſiſtance of that diſtant and haughty republic, when they could avail themſelves of the powerful kingdom of Macedon, which wiſhed

wiſhed for nothing more than to enter into equal and laſting engagements with their confederacy. As a proof of his moderation and ſincerity, he offered to put them in poſſeſſion of Anthemus, an important town in the neighbourhood, of which the Macedonians had long claimed the juriſdiction, making many other fair promiſes; and among the reſt, that he would reduce for them the cities of Pydna and Potidæa, which he choſe rather to ſee in dependence on Olynthus than Athens. Thus he prevailed upon the Olynthians not only to abandon Amphipolis, but to aſſiſt him with all their power in the execution of his deſigns.

Philip now loſt no time in executing his purpoſes on Amphipolis; and preſſed the city ſo cloſely, that the people were glad to apply to the Athenians for relief. Accordingly they diſpatched two of their moſt eminent citizens, Hierax and Stratocles, to repreſent the danger of an alliance betwixt Philip and the Olynthians, and to profeſs their ſorrow for having ſo deeply offended the parent ſtate. This repreſentation had ſuch an effect, that though the Athenians were then deeply engaged in the ſocial war, they would probably have paid ſome attention to the Amphipolitans, had not Philip taken care to ſend them a letter with freſh aſſurances of friendſhip, acknowledging their right to Amphipolis, and which he hoped ſhortly to put into their hands in terms of his recent agreement. By theſe ſpecious pretences the Athenians were perſuaded to pay as little regard to the deputies of the Amphipolitans as they had already done to thoſe of the Olynthians; ſo that the city, unable to defend itſelf alone againſt ſo powerful an army, ſurrendered at laſt at diſcretion in the year 357 B. C.

32
Amphipolis ſurrenders.

33
Makes himſelf maſter of the gold mines of Thrace.

Philip ſtill proceeded in the ſame cautious and politic manner in which he had begun. Though the obſtinate defence of the Amphipolitans might have furniſhed a pretence for ſeverity, he contented himſelf with baniſhing a few of the popular leaders from whom he had moſt cauſe to dread oppoſition, treating the reſt of the inhabitants with all manner of clemency; but took care to add Amphipolis to his own dominions, from which he was determined that it never ſhould be ſeparated, notwithſtanding the promiſes he had made to the Athenians. Finding that it was not his intereſt at this time to fall out with the Olynthians, he cultivated the friendſhip of that republic with great aſſiduity; took the cities of Pydna and Potidæa, which he readily yielded to the Olynthians, though they had given him but little aſſiſtance in the reduction of theſe places. Potidæa had been garriſoned by the Athenians; and them the artful king ſent back without ranſom, lamenting the neceſſity of his affairs which obliged him, contrary to his inclination, to oppoſe their republic. Though this was rather too groſs, the Atheniens at preſent were ſo much engaged with the ſocial war, that they had not leiſure to attend to the affairs of other nations. Philip made the beſt uſe of his time, and next projected the conqueſt of the gold mines of Thrace. That rich and fertile country was now held by one Cotys, a prince of ſuch weak intellectual faculties, that the ſuperſtition of the Greeks, into which he was newly initiated, had almoſt entirely ſubverted his reaſon; and he wandered about in queſt of the goddeſs Minerva, with whom he fancied himſelf in love. The invaſion of the Macedonians, however, awaked him from reverie; and Cotys, finding himſelf deſtitute of other means of oppoſition, attempted to ſtop the progreſs of the enemy by a letter. To this Philip paid no regard: the Thracians were inſtantly expelled from their poſſeſſions at Crenidæ, where there were very valuable gold mines. Theſe had formerly been worked by colonies from Thaſos and Athens; but the coloniſts had long ſince been expelled by the barbarous Thracians, who knew not how to make uſe of the treaſure they were in poſſeſſion of. Philip took the trouble to deſcend into the mines himſelf, in order to inſpect the works; and having cauſed them to be repaired, planted a Macedonian colony at Crenidæ, beſtowed upon it the name of Philippi, and drew annually from the gold mines to the value of near 1000 talents, or 200,000 l. ſterling; an immenſe ſum in thoſe days. The coins ſtruck here were likewiſe called Philippi.

34
Settles the affairs of Theſſaly greatly to his advantage.

Philip having obtained this valuable acquiſition, next took upon him to ſettle the affairs of Theſſaly, where every thing was in confuſion. This country had been formerly oppreſſed by Alexander tyrant of Phedræ; after whoſe death three others appeared, *viz.* Tiſiphornus, Pitholaus, and Lycophron, the brothers-in-law of Alexander, who had likewiſe murdered him. By the united efforts of the Theſſalians and Macedonians, however, theſe uſurpers were eaſily overthrown, and effectually prevented from making any diſturbances for the future; and the Theſſalians, out of a miſtaken gratitude, ſurrendered to Philip all the revenues ariſing from their fairs and towns of commerce, as well as all the conveniences of their harbours and ſhipping; a conceſſion which Philip took care to ſecure in the moſt effectual manner.

35
Marries Olympias.

36
A general combination of the neighbouring princes formed againſt him.

37
Defeats his enemies.

Having now not only eſtabliſhed his ſovereignty in the moſt effectual manner, but rendered himſelf very powerful and formidable to his neighbours, Philip determined to enjoy ſome repoſe from his fatigues. Having formed an alliance with Arybbas king of Epirus, he, in the year 357 B. C. married Olympias the ſiſter of that prince; a match thought the more eligible, as the kings of Epirus were ſuppoſed to be deſcended from Achilles. The nuptials were ſolemnized at Pella with great pomp, and ſeveral months were ſpent in ſhows and diverſions: during which Philip ſhowed ſuch an extreme proneneſs to vice of every kind, as diſgraced him in the eyes of his neighbours, and moſt probably laid the foundation of his future domeſtic unhappineſs. So much was this behaviour of the Macedonian monarch taken notice of by the neighbouring ſtates, that the Pæonians and Illyrians threw off the yoke, engaging in their ſchemes the king of Thrace: and notwithſtanding the inſane ſtate of that prince, their deſigns were now carried on with more judgment than was uſual with barbarians. Philip, however, notwithſtanding his diſſipation, got warning of his danger in ſufficient time to prevent the bad conſequences which might have enſued had the confederates got time to bring their matters to a proper bearing. Early in the ſpring 356 he took the field with the flower of the Macedonian troops. Having marched in perſon againſt the Pæonians and Thracians, he diſpatched Parmenio his beſt general into Illyria. Both enterpriſes proved ſucceſsful; and while Philip returned victorious from Thrace, he received an account of the

victory

victory gained by Parmenio; a ſecond meſſenger informed him of a victory gained by his chariot at the Olympic games; and a third, that Olympias had been delivered of a ſon at Pella. 38 Birth of Alexander the Great. This was the celebrated Alexander, to whom the diviners propheſied the higheſt proſperity and glory, as being born in ſuch auſpicious circumſtances.

39 Ariſtotle appointed his preceptor. A ſhort time after the birth of Alexander, Philip wrote a letter to the philoſopher Ariſtotle, whom he choſe for preceptor to his young ſon. The letter was written with great brevity, containing only the following words: "Know that a ſon is born to us. We thank the gods not ſo much for their gift, as for beſtowing it at a time when Ariſtotle lives. We aſſure ourſelves that you will form him a prince worthy of his father, and worthy of Macedon." 40 Extent of the Macedonian territories. He next ſet about the farther enlargement of his territories, which were already very conſiderable. Pæonia was now one of his provinces; on the eaſt his dominions extended to the ſea of Thaſos, and on the weſt to the lake Lychnidus. The Theſſalians were in effect ſubject to his juriſdiction, and the poſſeſſion of Amphipolis had ſecured him many commercial advantages; he had a numerous and well-diſciplined army, with plentiful reſources for ſupporting ſuch an armament, and carrying through the other ſchemes ſuggeſted by his ambition; though his deep and impenetrable policy rendered him more truly formidable than all theſe put together. 41 Projects the conqueſt of Olynthus and of all Greece. His firſt ſcheme was the reduction of Olynthus, the moſt populous and fertile country on the borders of Macedon; after which his ambition prompted him to acquire the ſovereignty of all Greece. To accompliſh the former, he had hitherto courted the friendſhip of the Olynthians by every poſſible method; and without letting ſlip an opportunity to accompliſh the latter, he deprived the Athenians gradually of ſeveral of their ſettlements in Thrace and Macedon. In theſe depredations, however, he took care always to give ſuch appearance of juſtice to his actions, that his antagoniſts, who had ſtudied the matter leſs deeply, could not find a plauſible pretext for engaging in war againſt him, even when he had openly committed hoſtilities againſt them. Philip eaſily perceived that the affairs of the Greeks were coming to a criſis, and he determined to wait the event of their mutual diſſenſions. 42 Account of the Phocian war. That event did not diſappoint his hopes. The Phocians had violated the religion of thoſe days in a moſt extraordinary manner: they had even ploughed up the lands conſecrated to Apollo: and however they might pretend to excuſe themſelves by examples, the Amphictyons fulminated a degree againſt the Phocians, commanding the ſacred lands to be laid waſte, and impoſing an heavy fine upon the community.

By this decree all Greece was again involved in the war called *Phocian*, from the name of the city about which it commenced. Philip at beginning of the troubles was engaged in Thrace, where a civil war had taken place among the ſons of Cotys; and wherever Philip interfered, he was ſure to make matters turn out to his own advantage. His incroachments at length became ſo enormous, that Kerſobletes, the moſt powerful of the contending princes, agreed to cede the Thracian Cherſoneſus to the Athenians; who immediately ſent Chares at the head of a powerful armament to take poſſeſſion of it. In this expedition the town of Seſtos was taken by ſtorm, and the inhabitants cruelly treated by Chares, while Philip employed himſelf in the ſiege of Methone in Pieria. 43 Philip loſes an eye at the ſiege of Methone. This city he likewiſe reduced; but the king loſt an eye at the ſiege in the following extraordinary manner, if we may give credit to ſome ancient hiſtorians. A celebrated archer, named Aſter, had it ſeems offered his ſervices to Philip, being repreſented as ſuch an excellent markſman, that he could hit the ſwifteſt bird on the wing. Philip replied, that he would be of excellent uſe if they were to make war with ſtarlings. Aſter, diſguſted with this reception, went over to the enemy, and with an arrow wounded the king in the eye. When the weapon was extracted, it was found to have on it the following inſcription: "For the right eye of Philip." The king ordered the arrow to be ſhot back again, with another inſcription, importing that he would cauſe Aſter to be hanged when the town was taken. A report was raiſed after Philip's death that he had loſt his eye by prying too narrowly into the amours of Olympias and Jupiter Ammon; which the vanity of his ſucceſſor prompted him to cheriſh, as his flatterers had probably been the inventors of it.

All this time the Phocian war raged with the greateſt fury, and involved in it all the ſtates of Greece. Lycophron, one of the Theſſalian tyrants, whom Philip had formerly deprived of his authority, had again found means to re-eſtabliſh his authority; and his countrymen having taken part with the Phocians, Lycophron called in Onomarchus the Phocian general to protect him againſt the power of Philip, by whom he was ſenſible that he would ſoon be attacked. 44 Is engaged in a war with Onomarchus the Phocian general. The king accordingly marched into Theſſaly with a conſiderable army, defeated Phyallus the brother of Onomarchus, whom the latter had ſent into the country with a detachment of 7000 men. After this he beſieged and took the city of Pegaſæ, driving the enemy towards the frontiers of Phocis. 45 Who defeats him. Onomarchus then advanced with the whole army; and Philip, though inferior in numbers, did not decline the engagement. The Phocians at firſt gave ground, on which the Macedonians purſued, but in good order; but coming near a precipice, on the top of which Onomarchus had poſted a detachment of ſoldiers, the latter rolled down ſtones and fragments of the rock in ſuch a manner as did dreadful excution, and threw them into the utmoſt diſorder. Philip, however, rallied his troops with great preſence of mind, and prevented the Phocians from gaining any farther advantage than they had already done; ſaying, as he drew off his men, that they did not retreat through fear, but like rams, in order to ſtrike with the greater vigour. Nor was he long before he made good his aſſertion; for having recruited his army with the greateſt expedition, he returned into Theſſaly at the head of 20,000 foot and 500 horſe, where he was met by Onomarchus. 46 But is at laſt defeated and killed. The Macedonians at this time were ſuperior in number to their enemies; and Philip moreover took care to remind them, that their quarrel was that of heaven, and that their enemies had been guilty of ſacrilege, by profaning the temple of Delphi. That they might be ſtill more animated in the cauſe, he put crowns of laurel on their heads. Thus fired by enthuſiaſm, and having beſides the advantage of numbers, the Phocians were altogether unable to withſtand them. They threw away their

their arms and fled towards the ſea, where they expected to have been relieved by Chares, who, with the Athenian fleet, was nigh the ſhore: but in this they were diſappointed, for he made no attempt to ſave them. Upwards of 6000 periſhed in the field of battle or in the purſuit, and 3000 were taken priſoners. The body of Onomarchus being found among the ſlain, was by order of Philip hung up on a gibbet as a mark of infamy, on account of his having polluted the temple; the bodies of the reſt were thrown into the ſea, as being all partakers of the ſame crime. The fate of the priſoners is not known, by reaſon of an ambiguity in a ſentence of Diodorus Siculus, which may imply that they were drowned, though it does not expreſsly ſay ſo.

47
Philip purſues his ambitious ſchemes.

After this victory Philip ſet about the ſettlement of Theſſaly, waiting only for an opportunity to put in execution his favourite ſcheme of invading Greece. In the mean time he rejoiced to ſee the ſtates weakening each other by their mutual diſſenſions; of which he never failed to take advantage as far as poſſible. He now, however, began to throw off the maſk with regard to the Olynthians, whom he had long deceived with fair promiſes. Having detached Kerſobletes from the intereſt of the Athenians, he eſtabliſhed him in the ſovereignty of Thrace; not out of any good will, but with a view to deſtroy him whenever a proper opportunity offered. Were he once poſſeſſed of the dominions of that prince, the way to Byzantium was open to him; the poſſeſſion of which muſt have been a great temptation to Philip, who well knew how to value the importance of its ſituation both with reſpect to commerce and war; and in order to pave the way to this important conqueſt, he attacked the fortreſs of Heræum, a ſmall and in itſelf unimportant place, though, by reaſon of its neighbourhood to Byzantium, the acquiſition was valuable to Philip. The Athenians, however, at laſt began to perceive the deſigns of Philip, and determined to counteract them. For this purpoſe they entered into an alliance with Olynthus; and having warned Kerſobletes of his danger, they ordered a powerful fleet to the defence of the Heræum. But theſe vigorous meaſures were ſoon counteracted by the report of Philip's death, which had been occaſioned by his wound at Methone, and a diſtemper ariſing from the fatigues he had afterwards undergone. The inconſtant Athenians too eaſily gave credit to this report; and, as if all danger had been over with his death, diſcontinued their preparations, and directed their whole attention to the ſacred war. —This conteſt, inſtead of being ended by the death of Onomarchus, now raged with double fury. Phyallus, abovementioned, the only ſurviving brother of Onomarchus, undertook the cauſe of the Phocians; and his affairs becoming every day more and more deſperate, he undertook the moſt unaccountable method of retrieving them which could be imagined; having converted into ready money the moſt precious materials belonging to the temple at Delphi, and with this treaſure doubled the pay of his ſoldiers. By this new piece of ſacrilege, he indeed brought many adventurers to his ſtandard, though he cut off all hopes of mercy for himſelf or his party ſhould he be defeated. Having the aſſiſtance of 1000 Lacedemonians, 2000 Achæans, and 5000 Athenian foot, with 400 cavalry, he was ſtill enabled to make a very formidable appearance; and the Phocians took the field with great proſpect of ſucceſs.

48
Is oppoſed by the Athenians.

49
Continuation of the Phocian war.

50
Philip engages in the quarrel.

Philip now thought it time to throw off the maſk entirely, for which the proceeding of the Athenians, particularly their league with Olynthus, furniſhed him with a plauſible pretext; and the revenging ſuch horrid ſacrilege as had been committed at Delphi ſeemed to give him a title to march at the head of an army into Greece. The ſuperſtition of the Greeks, however, had not yet blinded them to ſuch a degree, but they could eaſily perceive that Philip's piety was a mere pretence, and that his real deſign was to invade and conquer the whole country. The Athenians no ſooner heard of the march of the Macedonian army than they diſpatched, with all expedition, a ſtrong guard to ſecure the paſs of Thermopylæ; ſo that Philip was obliged to return greatly chagrined and diſappointed. Their next ſtep was to call an aſſembly, to deliberate upon the meaſures proper to be taken in order to reſtrain the ambition of the Macedonian monarch; and this aſſembly is rendered memorable by the firſt appearance of Demoſthenes as an orator againſt Philip. Athens for ſome time had been in a very alarming ſituation. They were deeply involved in the ſacred war; their northern poſſeſſions were continually inſulted and plundered by Philip; while a number of his mercenary partiſans drew off the public attention to ſuch a degree, that, inſtead of taking meaſures to counteract that ambitious prince, they amuſed themſelves with ſpeculations about the deſigns of the Perſian monarch, who was preparing for war againſt the Cyprians, Egyptians, and Phœnicians. Iſocrates the celebration orator, and Phocion the ſtateſman, joined the multitude in their preſent opinion though not from any mercenary motives, but purely from a ſenſe of the unſteady conduct of the Athenians: who, they were aſſured, could not contend with a prince of the vigour and activity of Philip; and therefore exhorted them by all means to cultivate the friendſhip of Philip, whom they could not oppoſe with any probability of ſucceſs. Iſocrates, indeed, greatly wiſhed for an expedition into Aſia, and looked upon Philip to be the only general capable of conducting it, though at preſent the Greeks had no pretence for making war upon the Perſians, but that of revenging former injuries: and on this ſubject he addreſſed a diſcourſe to Philip himſelf; and it is even ſaid, that Iſocrates, by the power of his rhetoric, prevailed upon Philip and the Athenians to lay aſide their animoſities for a ſhort time, and conſent to undertake this expedition in conjunction.

51
Is prevented from entering Greece.

52
Extreme indolence and careleſſneſs of the Athenians.

53
Advice of Iſocrates the orator to them.

54
He and Phocion are oppoſed by Demoſthenes.

If this coalition, however, did really take place, it was of very ſhort duration. The views of Phocion and Iſocrates were violently oppoſed by Demoſthenes. Though ſenſible of the corruption and degenercay of his countrymen, he hoped to be able to rouſe them from their lethargy by dint of his eloquence; a talent he had been at great pains to cultivate, and in which he is ſaid to have excelled all men that ever exiſted.

55
Subſtance of his firſt diſcourſes,

In his firſt addreſſes to the people, this celebrated orator exhorted them to awake from their indolence, and to aſſume the direction of their own affairs. They had been too long governed, he ſaid, by the incapacity of a few ambitious men, to the great diſadvantage as well as diſgrace of the community. In the firſt place, an orator who had placed himſelf at the head of a faction of no more than 300 or 400, availed himſelf and his followers of the careleſsneſs and negligence of the people to rule them at pleaſure. From a conſideration of their preſent weakneſs and corruption, as well as of the deſigns and commotions of the neighbouring powers, he adviſed them to abandon all romantic and diſtant ſchemes of ambition; and inſtead of carrying their arms into remote countries, to prepare for repelling the attacks which might be made upon their own dominions. He inſiſted alſo upon a better regulation of their finances, a more equal diſtribution of the public burthens, in proportion to the abilities of thoſe upon whom they were laid, and upon the retrenching many ſuperfluous expences. Having pointed out in a ſtrong light the vigorous conduct of Philip; and ſhown by what means he had attained to ſuch a reſpectable footing in the world, he next laid down a proper plan for their military operations. He told them, that they were not yet prepared to meet Philip in the field; they muſt begin with protecting Olynthus and the Cherſoneſus, for which it would be neceſſary to raiſe a body of 2000 light armed troops, with a due proportion of cavalry, which ought to be tranſported under a proper convoy to the iſlands of Lemnos, Thaſos, and Sciathos, in the neighbourhood of Macedon. In theſe they would enjoy all kinds of neceſſaries in abundance, and might avail themſelves of every favourable incident, to appear at the firſt ſummons of their allies; and either to repel the incurſions of the Macedonians, or harraſs their territories. While this was going on, more vigorous preparations might be made for war at home; and it was propoſed, that only the fourth part of the Athenian citizens ſhould enliſt, and no more ſupplies were wanted at preſent but 90 talents. But notwithſtanding the moderation of theſe propoſals, and the urgent neceſſities of the ſtate, it was impoſſible to prevail upon the indolent and careleſs Athenians to provide for their own ſafety. They appear, indeed, at this time, to have been deſperately ſunk in effeminacy and diſſipation; which diſpoſition Philip took care to encourage to the utmoſt of his power. There was an aſſembly in the city called the *Sixty*, from their conſiſting originally of that number, who met expreſsly for the purpoſes of extinguiſhing all care about public affairs, and to intoxicate themſelves with every kind of pleaſure they had in their power. With this aſſembly Philip was ſo well pleaſed, that he ſent them money to ſupport their extravagancies; and ſo effectually did they anſwer his purpoſes, that all the eloquence of Demoſthenes could not counteract the ſpeeches of orators much his inferiors when backed by Macedonian gold.

Philip himſelf, as we have already hinted, was exceſſively debauched in his private character, and the moſt ſhameful ſtories are related of him by the ancient writers, particularly by Demoſthenes. Theopompus too, an author who flouriſhed in the time of Alexander, and was rewarded and honoured by that monarch, alſo ſpeaks of him in ſuch terms as we cannot with decency relate: but theſe accounts coming from the avowed enemies of the king, are ſcarcely to be credited; and perhaps *policy*, as well as inclination, might contribute ſomewhat to this ſcandalous behaviour, that he might thereby recommend himſelf to the libertines of Athens, and prevent even many of the more thinking part of the people from ſuſpecting his deſigns. But in whatever exceſſes he might at times indulge himſelf, he never loſt ſight of his main object, the ſubjugation of the Greek ſtates. On pretence of being in want of money to defray the expence of his buildings, he borrowed money at a very high price throughout the whole country: and this he found an eaſy matter to do, as the diſſipation of the Delphic treaſures had rendered caſh very plentiful in Greece. Thus he attached his creditors firmly to his own intereſt; and on pretence of paying debts, was enabled without moleſtation to beſtow a number of penſions and gratuities upon the Athenian orators, who by their treacherous harangues contributed greatly to the ruin of their country; at leaſt as far as it could be ruined by ſubjection to a prince who would have obliged them to remain at peace, and apply themſelves to uſeful arts. Theſe he himſelf encouraged in a very eminent degree. The greateſt part of his time was employed at Pella, which city he adorned in the moſt magnificent manner with temples, theatres, and porticoes. He invited, by liberal rewards, the moſt ingenious artiſts in Greece; and as many of theſe met with very little encouragement in their own country, great numbers flocked to him from all quarters. In the government of his people, alſo, Philip behaved with the utmoſt impartiality; liſtening with condeſcenſion to the complaints of the meaneſt of his ſubjects; and keeping up a conſtant correſpondence with thoſe whom he thought worthy of his acquaintance; from which, it is not eaſy to imagine how he could be ſo guilty of the vices we have already mentioned from ſome ancient hiſtorians.

56
Over-reaches the Athenians, and at laſt concludes a peace.

The fate of Olynthus was now ſoon determined. This city, which held the balance of power betwixt Athens and Macedon, was taken and plundered, and the inhabitants ſold for ſlaves; but the chief hope of Philip was in putting an end to the Phocian war. For this purpoſe he affected a neutrality, that he might thereby become the arbiter of Greece. His hopes were well founded; for the Thebans, who were at the head of the league againſt the Phocians, ſolicited him on the one ſide, and the ſtates confederate with the Phocians did the like on the other. He anſwered neither, yet held both in dependence. In his heart he favoured the Thebans, or rather placed his hopes of favouring his own cauſe in that ſtate; for he well knew, that the Athenians, Spartans, and other ſtates allied with Phocis, would never allow him to paſs Thermopylæ, and lead an army into their territories. So much reſpect, however, did he ſhow to the ambaſſadors from theſe ſtates, particularly Cteſiphon and Phrynon, who came from Athens, that they believed him to be in their intereſt, and reported as much to their maſters. The Athenians, who were now diſſolved in eaſe and luxury, received this news with great ſatisfaction; and named immediately ten plenipotentiaries to go and treat of a full and laſting peace with Philip. Among theſe plenipotentiaries were Demoſthenes and Æſchines, the moſt celebrated orators in Athens. Philip gave directions that theſe ambaſſadors ſhould be treated with the utmoſt civility; naming at the ſame time, three of his miniſters to confer with them, viz. Antipater, Parmenio, and Eurylochus. Demoſthenes being obliged to return to Athens, recommended it to his colleagues not to carry on their negociations with Philip's deputies; but to proceed with all diligence to court, there to confer with the king himſelf. The ambaſſadors, however, were ſo far from following his inſtructions, that they ſuffered themſelves to be put off for three months by the arts of Philip and his miniſters.

In the mean time, the king took from the Athenians ſuch places in Thrace as might beſt cover his frontiers; giving their plenipotentiaries, in their ſtead, abundance of fair promiſes, and the ſtrongeſt aſſurances that his good will ſhould be as beneficial to them as ever their colonies had been. At laſt a peace was concluded; but then the ratification of it was deferred till Philip had poſſeſſed himſelf of Pherea in Theſſaly, and ſaw himſelf at the head of a numerous army: then he ratified the treaty; and diſmiſſed the plenipotentiaries with aſſurances, that he would be ready at all times to give the Athenians proofs of his friendſhip. On their return to Athens, when this matter came to be debated before the people, Demoſthenes plainly told them, that, in his opinion, the promiſes of Philip ought not to be relied on, becauſe they appeared to be of little ſignificance in themſelves, and came from a prince of ſo much art, and ſo little fidelity, that they could derive no authority from their maker. Æſchines, on the other hand, gave it as his ſentiment, that the king of Macedon's aſſurances ought to give them full ſatisfaction. He ſaid, that for his part, he was not politician enough to ſee any thing of diſguiſe or diſſimulation in the king's conduct; that there was great danger in diſtruſting princes; and that the ſureſt method of putting men upon deceit was to ſhow that we ſuſpected them of it. The reſt of the plenipotentiaries concurred with Æſchines; and the people, deſirous of quiet and addicted to pleaſure, eaſily gave credit to all that was ſaid, and decreed that the peace ſhould be kept. All this was the eaſier brought about, becauſe Phocion, the worthieſt man in the republic, did not oppoſe Philip; which was owing to his having a juſt ſenſe of the ſtate his country was in. He conceived, that the Athenians of thoſe times were nothing like their anceſtors; and therefore as he expreſſed himſelf on another occaſion, he was deſirous, ſince they would not be at the head of Greece themſelves, that they would at leaſt be upon good terms with that power which would be ſo.

57
Paſſes Thermopylæ, and ends the Phocian war.

Philip, who knew how to uſe as well as to procure opportunity, while the Athenians were in this good humour, paſſed Thermopylæ, without their knowing whether he would fall on Phocis or Thebes; but he quickly undeceived them, by commanding his ſoldiers to put on crowns of laurel, declaring them thereby the troops of Apollo, and himſelf the lieutenant general of that god. He then entered Phocis with an air of triumph; which ſo terrified the Phocians, whom he had cauſed to be proclaimed ſacrilegious perſons, that they immediately diſmiſſed all thoughts of defence, and without more ado ſubmitted to his mercy. Thus the Phocian war, which had ſo long employed all Greece, was ended without a ſtroke; and the judgment on the Phocians remitted to the Amphictyons, or grand council of Greece. By their decree the walls of three Phocian cities were demoliſhed, the people were forbid to inhabit in any but villages, to pay a yearly tribute of 60 talents, and never to make uſe either of houſes or arms till they had repaid to the temple of Apollo the money they had ſacrilegiouſly carried from thence. Their arms were taken from them, broken to pieces, and burnt; their double voice in the council was taken from them, and given to the Macedonians. Other orders were made for ſettling the affairs both of religion and ſtate throughout Greece: all of which were executed by Philip with great exactneſs and moderation, he paying the moſt profound reſpect to the council; and, when he had performed its commands, retiring peaceably with his army back to Macedon, which gained him great reputation.

58
Is again oppoſed by the Athenians.

At Athens alone, the juſtice and piety of Philip was not underſtood. The people began to ſee, though a little too late, that they had been abuſed and deceived by thoſe who had negociated the late peace. They ſaw, that, through their acceptance of it, the Phocians were deſtroyed; that Philip was become maſter of Thermopylæ, and might enter Greece when he pleaſed; that, in abandoning their allies, they had abandoned themſelves; and that, in all probability, they might ſoon feel the weight of his power, whom they had ſo fooliſhly truſted: they therefore began to take new and hoſtile meaſures; they ordered that the women ſhould retire out of the villages into the city, their walls be repaired, and their forts new ſtrengthened. They ſeemed inclined to queſtion Philip's election into the council of the Amphictyons, becauſe it had been done without their conſent; and even to proceed to an open war. In all likelihood they had carried things to extravagancy, if Demoſthenes had not interpoſed. He told them, that though he was not for making the peace, he was however for keeping it, and that he ſaw no manner of occaſion for their entering into ſo unequal a conteſt as would needs enſue, if they took up arms, not only againſt Philip, but againſt all the ſtates concurring with him in the late tranſactions. This ſeems to have cooled the rage of the Athenians: and to have brought them to think of *ruining* Philip by degrees, as by degrees they had *raiſed* him.

59
Purſues his conqueſts in Thrace.

60
His dominions invaded by Diopithes.

The fame of his atchievements without the bounds of Macedon having diſpoſed the ſubjects of Philip to hope every thing from his conduct, and the ſeveral ſtates of Greece to deſire above all things his friendſhip; that prudent monarch laid hold of this favourable ſituation to fix his dominion on ſuch a ſtable foundation as that a reverſe of fortune ſhould not immediately deſtroy it. To this end, while he carried on his negociations through Greece, he likewiſe kept his army in exerciſe, by taking ſeveral places in Thrace, which terribly incommoded the Athenians. Diopithes, who had the government of the Athenian colonies in thoſe parts, perceiving well what end Philip had in view, did not ſtay for inſtructions from home; but having raiſed with much expedition a conſiderable body of troops, taking advantage of the king's being abſent with his army, entered the adjacent territories of Philip, and waſted them with fire and ſword.

The king, who, on account of the operations of the campaign in the Cherſoneſe, was not at leiſure to repel Diopithes by force, nor indeed could divide his army without imminent hazard, choſe, like an able general, rather to abandon his provinces to inſults, which might be afterwards revenged, than, by following the dictates of an ill-timed paſſion, to hazard the loſs of his veteran army, whereon lay all his hopes. He contented himſelf, therefore, with complaining to the Athenians of Diopithes's conduct, who in a time of peace had entered his dominions, and committed ſuch devaſtations as could ſcarce have been juſtified in a time of war. His partiſans ſupported this application with all their eloquence. They told the Athenians, that unleſs they recalled Diopithes, and brought him to a trial for this infringement of the peace, they ought not to hope either for the friendſhip of Philip or of any other prince or ſtate; neither could they juſtly complain, if, prompted by ſuch a precedent, others ſhould break faith with them, and fall without the leaſt notice upon their dominions.

61
Who is defended by Demoſthenes.

Demoſthenes defended Diopithes; and undertook to ſhow that he deſerved the praiſe and not the cenſure of the Athenians. Thoſe of the other party began then to charge him with crimes of a different nature; they alleged, that he oppreſſed the ſubjects and maltreated the allies of Athens. Demoſthenes replied, that of theſe things there were as yet no proofs; that when ſuch ſhould appear, a ſingle galley might be ſent to bring over Diopithes to abide their judgment, but that Philip would not come if they ſent a fleet; whence he inferred, that they ought to be cautious, and to weigh well the merits of this cauſe before they took any reſolution. He ſaid, that it was true Philip had not as yet attacked Attica, or pretended to make a deſcent on their territories in Greece, or to force his way into their ports; when it came to that, he was of opinion they would be hardly able to defend themſelves; wherefore he thought ſuch men were to be eſteemed as fought to protect their frontiers, in order to keep Philip as long as might be at a diſtance: whereupon he moved that, inſtead of diſowning what Diopithes had done, or directing him to diſmiſs his army, they ſhould ſend him over recruits, and ſhow the king of Macedon they knew how to protect their territories, and to maintain the dignity of their ſtate as well as their anceſtors. Theſe arguments had ſuch an effect, that a decree was made conformable to his motion.

While affairs ſtood thus, the Illyrians recovering courage, and ſeeing Philip at ſuch a diſtance, haraſſed the frontiers of Macedon, and threatened a formidable invaſion: but Philip, by quick marches, arrived on the borders of Illyrium; and ſtruck this barbarous people with ſuch a panic, that they were glad to compound for their former depredations at the price he was pleaſed to ſet. Moſt of the Greek cities in Thrace now ſought the friendſhip of the king, and entered into a league with him for their mutual defence. As it cannot be ſuppoſed, that each of theſe free cities had a power equal to that of Philip, we may therefore look upon him as their protector.

62
Philip's ſchemes defeated.

About this time Philip's negociations in Peloponneſus began to come to light; the Argives and Meſſenians growing weary of that tyrannical authority which the Spartans exerciſed over them, applied to Thebes for aſſiſtance; and the Thebans, out of their natural averſion to Sparta, ſought to open a paſſage for Philip into Peloponneſus, that, in conjunction with them, he might humble the Lacedemonians. Philip readily accepted the offer; and reſolved to procure a decree from the Amphictyons, directing the Lacedemonians to leave Argos and Meſſene free; which if they complied not with, he, as the lieutenant of the Amphictyons, might, with great appearance of juſtice, march with a body of troops to enforce their order. When Sparta had intelligence of this ſhe immediately applied to Athens, earneſtly intreating aſſiſtance, as in the common cauſe of Greece. The Argives and Meſſenians, on the other hand, laboured aſſiduouſly to gain the Athenians to their ſide; alleging that, if they were friends to liberty, they ought to aſſiſt thoſe whoſe only aim was to be free. Demoſthenes, at this juncture, outwreſtled Philip, if we may borrow that king's expreſſion: for, by a vehement harangue, he not only determined his own citizens to become the avowed enemies of the king, but alſo made the Argives and Meſſenians not over fond of him for an ally; which when Philip perceived, he laid aſide all thoughts of this enterpriſe for the preſent, and began to practiſe in Eubœa.

This country, now called *Negropont*, is ſeparated from Greece by the Euripus, a ſtrait ſo narrow, that Eubœa might eaſily be united to the continent. This ſituation made Philip call it *the fetters of Greece*, which he therefore ſought to have in his own hands. There had been for ſome years great diſturbances in that country; under colour of which, Philip ſent forces thither, and demoliſhed Porthmos, the ſtrongeſt city in thoſe parts, leaving the country under the government of three lords, whom Demoſthenes roundly calls *tyrants* eſtabliſhed by Philip. Shortly after, the Macedonians took Oreus, which was left under the government of five magiſtrates, ſtyled alſo *tyrants* at Athens. Thither Plutarch of Eretria, one of the moſt eminent perſons in Eubœa, went to repreſent the diſtreſſes of his country, and to implore the Athenians to ſet it free. This ſuit Demoſthenes recommended warmly to the people; who ſent thither their famous leader Phocion, ſupported by formidable votes, but a very ſlender army: yet ſo well did he manage the affairs of the commonwealth and her allies, that Philip quickly found he muſt for a time abandon that project; which, however, he did not till he had formed another no leſs beneficial to himſelf, or leſs dangerous to Athens. It was, the proſecution of his conqueſts in Thrace, which he thought of puſhing much farther than he had hitherto done, or could be reaſonably ſuſpected to have any intention of doing.

Extraordinary preparations were made by the Macedonian monarch for this campaign. His ſon Alexander was left regent of the kingdom; and he himſelf with 30,000 men laid ſiege to Perinthus, one of the ſtrongeſt cities in the country. At preſent, however, all his arts of cajoling and pretending friendſhip were inſufficient to deceive the Athenians. They gave the command of their army and fleet to Phocion; a general of great abilities, and with whom Philip would have found it very hard to contend. On the other hand, the king of Perſia began to turn jealous of the growing power of the Macedonian monarch. The Perſian kings had been accuſtomed to regard thoſe of Macedon as their faithful allies; but the good fortune of Philip, the continual clamour of the Athenians againſt him, and his dethroning at pleaſure the petty princes of Thrace, made him now regarded in another light. When therefore he led his troops againſt Perinthus, *the Great King*, as he was ſtyled by the Greeks, ſent his letters mandatory to the governors of the maritime provinces, directing them to ſupply the place with all things in their power; in conſequence of which they filled it with troops, granted ſubſidies in ready money, and ſent beſides great convoys of proviſions and ammunition. The Byzantines alſo, ſuppoſing their own turn would be next, exerted their utmoſt endeavours for the preſervation of Perinthus: ſending thither the flower of their youth, with all other neceſſaries for an obſtinate defence. The conſequence of all this was, that Philip found himſelf obliged to raiſe the ſiege with great loſs.

63
How he at laſt gained his point.

That the reputation of the Macedonian arms might not ſink by this diſgrace, Philip made war on the Scythians and Triballi, both of whom he defeated; and then formed a deſign of invading Attica, though he had no fleet to tranſport his troops, and knew very well that the Theſſalians were not to be depended upon if he attempted to march through the Piſæ, and that the Thebans would even then be ready to oppoſe his march. To obviate all theſe difficulties, he had recourſe to Athens itſelf; where, by means of his partiſans, he procured his old friend Æſchines to be ſent their deputy to the Amphictyons. This ſeemed a ſmall matter, and yet was the hinge on which his whole project turned. By that time Æſchines had taken his ſeat, a queſtion was ſtirred in the council, whether the Locrians of Amphiſia had not been guilty of ſacrilege in ploughing the fields of Cyrrha in the neighbourhood of the temple of Delphi. The aſſembly being divided in their opinions, Æſchines propoſed to take a view; which was accordingly decreed. But when the Amphictyons came in order to ſee how things ſtood, the Locrians, either jealous of their property, or ſpurred thereto by the ſuggeſtions of ſome who ſaw farther than themſelves, fell upon thoſe venerable perſons ſo rudely, that they were compelled to ſecure themſelves by flight. The Amphictyons decreed, that an army ſhould be raiſed, under the command of one of their own number, to chaſtiſe the delinquents; but as this army was to be compoſed of troops ſent from all parts of Greece, the appearance at the rendezvous was ſo inconſiderable, that the Amphictyons ſent to command them durſt undertake nothing. The whole matter being reported to the council, Æſchines in a long and eloquent harangue, ſhowed how much the welfare and even the ſafety of Greece depended on the deference paid to their decrees; and after inveighing againſt the want of public ſpirit in ſuch as had not ſent their quotas at the time appointed by the council, he moved that they ſhould elect Philip for their general, and pray him to execute their decree. The deputies from the other ſtates, conceiving that by this expedient their reſpective conſtituents would be free from any farther trouble or expence, came into it at once; whereupon a decree was immediately drawn up, purporting that ambaſſadors ſhould be ſent to Philip of Macedon, in the name of Apollo and the Amphictyons, once more to require his aſſiſtance, and to notify to him, that the ſtates of Greece had unanimouſly choſen him their general, with full power to act as he thought fit againſt ſuch as had oppoſed the authority of the Amphictyons.

64
Is choſen general by the Amphictyons.

Thus of a ſudden Philip acquired all that he ſought; and having an army ready in expectation of this event, he immediately marched to execute the commands of the Amphictyons in appearance, but in reality to accompliſh his own deſigns. For having paſſed into Greece with his army, inſtead of attacking the Locrians, he ſeized immediately upon Elatea a great city of Phocis upon the river Cephiſus.

65
Is oppoſed by the Athenians and Thebans.

The Athenians in the mean time were in the utmoſt confuſion on the news of Philip's march. However by the advice of Demoſthenes, they invited the Thebans to join them againſt the common enemy of Greece. Philip endeavoured as much as poſſible to prevent this confederacy from taking place; but all his efforts proved ineffectual. The Athenians raiſed an army, which marched immediately to Eleuſis, where they were joined by the Thebans. The confederates made the beſt appearance that had ever been ſeen in Greece, and the troops were exceedingly good; but unfortunately the generals were men of no conduct or ſkill in the military art.

66
Whom he defeats at Cheronæa.

An engagement enſued at Cheronæa; wherein Alexander commanded one wing of the Macedonian army, and his father Philip the other. The confederate army was divided according to the different nations of which it conſiſted; the Athenians having the right and the Bœotians the left. In the beginning of the battle the confederates had the better; whereupon Stratocles an Athenian commander cried out, "Come on brother ſoldiers, let us drive them back to Macedon:" which being overheard by the king, he ſaid very coolly to one of his officers, "Theſe Athenians do not know how to conquer." Upon this he directed the files of the phalanx to be ſtraitened; and drawing his men up very cloſe, retired to a neighbouring eminence: from whence, when the Athenians were eager in their purſuit, he ruſhed down with impetuoſity, broke, and routed them with prodigious ſlaughter. The orator Demoſthenes behaved very unbecomingly in this engagement; for he deſerted his poſt, and was one of the firſt that fled: nay, we are told, that a ſtake catching hold of his robe, he, not doubting but it was an enemy, cried out, "Alas! ſpare my life."

67
Is appointed general againſt the Perſians.

This victory determined the fate of Greece; and from this time we muſt reckon Philip ſupreme lord of all the Grecian ſtates. The firſt uſe he made of his power was to convoke a general aſſembly, wherein he was recogniſed generaliſſimo, and with full power appointed their leader againſt the Perſians. Having, by virtue of his authority, ſettled a general peace among them, and appointed the quota that each of the ſtates ſhould furniſh for the war, he diſmiſſed them; and returning to Macedon, began to make great preparations for this new expedition. His pretence for making war on the Perſians at this time was the aſſiſtance given by the Perſians to the city of Perinthus, as already mentioned. In the mean time, however, the king, by reaſon of the diſſenſions which reigned in his family, was made quite miſerable. He quarrelled with his wife Olympias to ſuch a degree, that he divorced her, and married another woman named *Cleopatra*. This produced a quarrel between him and his ſon Alexander; which alſo came to ſuch an height, that Alexander retired into Epirus with his Mother. Some time afterwards, however, he was recalled, and a reconciliation took place in appearance; but in the mean time a conſpiracy was formed againſt the king's life, the circumſtances and cauſes of which are very much unknown. Certain it is, however, that it took effect, as the king was exhibiting certain ſhows in honour of his daughter's marriage with the king of Epirus. Philip, having giving a public audience to the ambaſſadors of Greece, went next day in ſtate to the theatre. All the ſeats were early taken up; and the ſhows began with a ſplendid proceſſion, wherein the images of the 12 ſuperior deities of Greece were carried, as alſo the image of Philip, habited in like manner, as if he now made the 13th, at which the people ſhouted aloud. Then came the king alone, in a white robe, crowned, with his guards at a conſiderable diſtance, that the Greeks might ſee he placed his ſafety only in his confidence of the loyalty of his ſubjects. Pauſanius, the aſſaſſin, however, had fixed himſelf cloſe by the door of the theatre; and obſerving that all things fell out as he had foreſeen they would, took his opportunity when the king drew near him, and plunging his ſword in his left ſide, laid him dead at his feet. He then fled as faſt as he was able towards the place where his horſes were; and would have eſcaped, had not the twig of a vine catched his ſhoe and thrown him down. This gave time to thoſe who purſued him to come up with him; but inſtead of ſecuring him, in order to extort a diſcovery of his accomplices, they put an end to his life.

68
Is murdered.

69
His character.

With regard to the character of this monarch, it appears certain, that he was one of the moſt eminent perſons that ever ſat on a throne. Had he lived for ſome time longer, he would in all probability have ſubdued the Perſians; which was in truth leſs difficult than what he had already done. "Had that event taken place (ſays Dr Gillies), the undertakings of his long and ſucceſsful reign would have been enobled and illuminated by the ſplendor of extenſive foreign conqueſt. Philip would have reached the height of ſuch renown as is obtained by the habits of activity, vigilance, and fortitude, in the purſuit of unbounded greatneſs: and in the opinion of poſterity, would perhaps have ſurpaſſed the glory of all kings and conquerors who either preceded or followed him. Yet, even on this ſuppoſition, there is not any man of ſenſe and probity, who, if he allows himſelf time for ſerious reflection, would purchaſe the imagined grandeur and proſperity of the king of Macedon at the price of his artifices and his crimes; and to a philoſopher, who conſidered either the means by which he had obtained his triumphs, or the probable conſequences of his dominion over Greece and Aſia; the buſy ambition of this mighty conqueror would appear but a deceitful ſcene of ſplendid miſery."

70
Extravagant joy of the Athenians.

No ſooner did the news of Philips death reach Athens, than, as if all danger had been paſt, the inhabitants ſhowed the moſt extravagant ſigns of joy. Demoſthenes and his party put on chaplets of flowers, and behaved as if they had gained a great victory. Phocion reproved them for this madneſs; bidding them remember that "the army which had beaten them at Cheronæa was leſſened but by one." This reproof, however, had very little effect. The people heard with pleaſure all the harſh things which the orators could ſay of the young Alexander king of Macedon, whom they repreſented as a giddy wrong-headed boy, ready to graſp all things in his imagination, and able to perform nothing. The affairs of Macedon indeed were in a very diſtracted ſtate on the acceſſion of Alexander: for all the neighbouring nations had the ſame notion of the young king with the Athenians; and being irritated by the uſurpations of Philip, immediately revolted; and the ſtates of Greece entered into a confederacy againſt him. The Perſians had been contriving to transfer the war into Macedon; but as ſoon as the news of Philip's death reached them, they behaved as if all danger had been over. At the ſame time Attalus, one of the Macedonian commanders aſpired to the crown, and ſought to draw off the ſoldiers from their allegiance.

71
Alexander declared general of Greece.

In the councils held on this occaſion, Alexander's beſt friends adviſed him rather to make uſe of diſſimulation than force, and to cajole thoſe whom they thought he could not ſubdue. Theſe advices, however were ill-ſuited to the temper of their monarch. He thought that vigorous meaſures only were proper, and therefore immediately led his army into Theſſaly. Here he harangued the princes ſo effectually, that he thoroughly gained them over to his intereſts, and was by them declared general of Greece; upon which he returned to Macedon, where he cauſed Attalus to be ſeized and put to death.

72
Defeats the Triballi.

In the ſpring of the next year (335 B. C.) Alexander reſolved to ſubdue the Triballians and Illyrians, who inhabited the countries now called *Bulgaria* and *Sclavonia*, and had been very formidable enemies to the Macedonian power. In this expedition he diſcovered, though then but 20 years of age, a ſurpriſing degree of military knowledge. Having advanced to the paſſage of Mount Hæmus he found that the barbarians had poſted themſelves in the moſt advantageous manner. On the tops of the cliffs, and at the head of every paſſage, they had placed their carriages and waggons in ſuch a manner as to form a kind of parapet with their ſhafts inwards, that when the Macedonians ſhould have half aſcended the rock, they might be able to puſh theſe heavy carriages down upon them. They reckoned the more upon this contrivance, becauſe of the cloſe order of the phalanx, which, they imagined, would be terribly expoſed by the ſoldiers wanting room to ſtir, and thereby avoid the falling waggons. But Alexander, having directed his heavy-armed troops to march, gave orders, that, where the way would permit, they ſhould open to the right and left, and ſuffer the carriages to go through; but that, in the narrow paſſes, they ſhould throw themſelves on their faces with their ſhields behind them, that the carts might ran over them. This had the deſired effect, and the Macedonians reached the enemy's works without the loſs of a man. The diſpute was then quickly decided; the barbarians were driven from their poſts with great ſlaughter, and left behind them a conſiderable booty for the conquerors.

The next exploits of Alexander were againſt the Getæ, the Taulantii, and ſome other nations inhabiting the country on the other ſide of the Danube. Them he alſo overcame; ſhowing in all his actions

73 The Thebans revolt on the news of his death.

74 Thebes taken and deſtroyed.

the moſt perfect ſkill in military affairs, joined with the greateſt valour. In the mean time, however, all Greece was in commotion by a report which had been confidently ſpread abroad, that the king was dead in Illyria. The Thebans, on this news, ſeized Amyntas and Timolaus, two eminent officers in the Macedonian Garriſon which held their citadel, and dragged them to the market-place, where they were put to death without either form or proceſs, or any crime alleged againſt them. Alexander, however, did not ſuffer them to remain long in their miſtake. He marched with ſuch expedition, that in ſeven days he reached Pallene in Theſſaly; and in ſix days more he entered Bœotia, before the Thebans had any intelligence of his paſſing the ſtraits of Thermopylæ. Even then they would not believe that the king was alive; but inſiſted that the Macedonian army was commanded by Antipater, or by one Alexander the ſon of Æropus. The reſt of the Greeks, however, were not ſo hard of belief; and therefore ſent no aſſiſtance to the Thebans, who were thus obliged to bear the conſequences of their own folly and obſtinacy. The city was taken by ſtorm, and the inhabitants were for ſome hours maſſacred without diſtinction of age or ſex; after which the houſes were demoliſhed, all except that of Pindar the famous poet, which was ſpared out of reſpect to the merit of its owner, and becauſe he had celebrated Alexander I. king of Macedon. The lands, excepting thoſe deſtined to religious uſes, were ſhared among the ſoldiers, and all the priſoners ſold for ſlaves; by which 440 talents were brought into the king's treaſury.

75 Number of the army with which he invaded Aſia.

By this ſeverity the reſt of the Grecian ſtates were ſo thoroughly humbled, that they thought no more of making any reſiſtance, and Alexander had nothing further to hinder him from his favourite project of invading Aſia. Very little preparation was neceſſary for the Macedonian monarch, who went out as to an aſſured conqueſt, and reckoned upon being ſupplied only by the ſpoils of his enemies. Hiſtorians are not agreed as to the number of his army: Arrian ſays, that there were 30,000 foot and 5000 horſe. Diodorus Siculus tells us, that there were 13,000 Macedonian foot, 7000 of the confederate ſtates, and 5000 mercenaries. Theſe were under the command of Parmenio. Of the Odriſians, Triballians, and Illyrians, there were 5000; and of the Agrians, who were armed only with darts, 1000. As for the horſe, he tells us there were 18,000 commanded by Philotas, and as many Theſſalians under the command of Callas: out of the confederate ſtates of Greece, were 600 commanded by Eurygius; and 900 Thracians and Phœnicians, who led the van under Caſſander. Plutarch tells us, that, according to a low computation, he had 30,000 foot and 5000 horſe; and, according to the largeſt reckoning, he had 34,000 foot and 4000 horſe. As to his fund for the payment of the army, Ariſtobulus ſays it was but 70 talents; and Oneſicritus, who was alſo in this expedition, not only takes away the 70 talents, but affirms that the king was 200 in debt. As for proviſions, there was juſt ſufficient for a month and no more; and to prevent diſturbances, Antipater was left in Macedon with 12,000 foot and 1500 horſe

76 Sets out on his expedition.

The army having aſſembled at Amphipolis, he marched from thence to the mouth of the river Strymon; then croſſing mount Pangæus, he took the road to Abdera. Croſſing the river Ebrus, he proceeded through the country of Pætis, and in 20 days reached Seſtos; thence he came to Eleus, where he ſacrificed on the tomb of Proteſilaus, becauſe he was the firſt among the Greeks who at the ſiege of Troy ſet foot on the Aſiatic ſhore. He did this, that his landing might be more propitious than that of the hero to whom he ſacrificed, who was ſlain ſoon after. The greateſt part of the army, under the command of Parmenio, embarked at Seſtos, on board a fleet of 160 galleys of three benches of oars, beſides ſmall craft. Alexander himſelf ſailed from Eleus; and when he was in the middle of the Helleſpont, offered a ball to Neptune and the Nereids, pouring forth at the ſame time a libation from a golden cup. When he drew near the ſhore, he lanched a javelin, which ſtruck in the earth: then in complete armour, he leaped upon the ſtrand; and having erected altars to Jupiter, Minerva, and Hercules, he proceeded to Ilium. Here again he ſacrificed to Minerva; and taking down ſome arms which had hung in the temple of that goddeſs ſince the time of the Trojan war, conſecrated his own in their ſtead. He ſacrificed alſo to the ghoſt of Priam, to avert his wrath on account of the deſcent which he himſelf claimed from Achilles

77 Conſequences of his firſt victory.

In the mean time the Perſians had aſſembled a great army in Phrygia; among whom was one Memnon a Rhodian, the beſt officer in the ſervice of Darius. Alexander, as ſoon as he had performed all the ceremonies which he judged neceſſary, marched directly towards the enemy. Memnon gave it as his opinion, that they ſhould burn and deſtroy all the country round, that they might deprive the Greeks of the means of ſubſiſting,, and then tranſport a part of their army into Macedon. But the Perſians, depending on their cavalry, rejected this ſalutary advice; and poſted themſelves along the river Granicus, in order to wait the arrival of Alexander. In the engagement which happened on the banks of that river, the Perſians were defeated †, and Alexander became maſter of all the neighbouring country; which he immediately began to take care of, as if it had been part of his hereditary dominions. The city of Sardis was immediately delivered up; and here Alexander built a temple to Jupiter Olympius. After this, he reſtored the Epheſians to their liberty; ordered the tribute which they formerly paid to the Perſians to be applied towards the rebuilding of the magnificent temple of Diana; and having ſettled the affairs of the city, marched againſt Miletus. This place was defended by Memnon with a conſiderable body of troops who had fled thither after the battle of Granicus, and therefore made a vigorous reſiſtance. The fortune of Alexander, however, prevailed; and the city was ſoon reduced, though Memnon with part of the troops eſcaped to Halicarnaſſus. After this, the king diſmiſſed his fleet, for which various reaſons have been aſſigned; though it is probable, that the chief one was to ſhow his army that their only reſource now was in ſubverting the Perſian empire.

Almoſt all the cities between Miletus and Halicarnaſſus ſubmitted as ſoon as they heard that the former was taken; but Halicarnaſſus, where Memnon commanded with a very numerous garriſon, made an obſtinate defence. Nothing, however, was able to reſiſt

† See *Granicus*.

the Macedonian army; Memnon was at laſt obliged to abandon the place; upon which Alexander took and raſed the city of Tralles in Phrygia; received the ſubmiſſion of ſeveral princes tributary to the Perſians; and having deſtroyed the Marmarians, a people of Lycia who had fallen upon the rear of his army, put an end to the campaign; after which he ſent home all the new married-men; in obedience, it would ſeem, to a precept of the Moſaic law, and which endeared him more to his ſoldiers than any other action of his life.

78 Unties the Gordian knot.

As ſoon as the ſeaſon would permit, Alexander quitted the province of Phaſelus; and having ſent part of his army through the mountainous country of Perga, by a ſhort but difficult road, took his rout by a certain promontory, where the way is altogether impaſſable, except when the north winds blow. At the time of the king's march the ſouth wind had held for a long time; but of a ſudden it changed, and blew from the north ſo violently, that, as he and his followers declared, they obtained a ſafe and eaſy paſſage through the Divine aſſiſtance. By many this march is held to be miraculous, and compared to that of the children of Iſrael through the Red Sea; while, on the other hand, it is the opinion of others, that there was nothing at all extraordinary in it. He continued his march towards Gordium, a city of Phrygia; the enemy having abandoned the ſtrong paſs of Telmiſſus, through which it was neceſſary for him to march. When he arrived at Gordium, and found himſelf under a neceſſity of ſtaying ſome time there till the ſeveral corps of his army could be united, he expreſſed a ſtrong deſire of ſeeing Gordius's chariot, and the famous knot in the harneſs, of which ſuch ſtrange ſtories had been publiſhed to the world. The cord in which this knot was tied, was made of the inner rind of the cornel-tree; and no eye could perceive where it had begun or ended. Alexander, when he could find no poſſible way of untying it, and yet was unwilling to leave it tied leſt it ſhould cauſe ſome fears in the breaſts of his ſoldiers, is ſaid by ſome authors to have cut the chords with his ſword, ſaying, "It matters not how it is undone." But Ariſtobulus aſſures us, that the king wreſted a wooden pin out of the beam of the waggon, which, being driven in acroſs the beam, held it up; and ſo took the yoke from under it. Be this as it will, however, Arrian informs us, that a great tempeſt of thunder, lightening, and rain, happening the ſucceeding night, it was held declarative of the true ſolution of this knot, and that Alexander ſhould become lord of Aſia.

79 His ſickneſs and recovery.

The king having left Gordium, marched towards Cilicia; where he was attended with his uſual good fortune, the Perſians abandoning all the ſtrong paſſes as he advanced. As ſoon as he entered the province, he received advice that Arſames, whom Darius had made governor of Tarſus, was about to abandon it, and that the inhabitants were very apprehenſive that he intended to plunder them before he withdrew. To prevent this, the king marched inceſſantly, and arrived juſt in time to ſave the city. But his ſaving it had well nigh coſt him his life: for, either through the exceſſive fatigue of marching, as ſome ſay, or, according to others, by his plunging when very hot into the river Cydnus, which, as it runs through thick ſhades, has its waters exceſſively cold, he fell into ſuch a diſtemper as threatened his immediate diſſolution. His army loſt their ſpirits immediately; the generals knew not what to do; and his phyſicians were ſo much affrighted, that the terror of his death hindered them from uſing the neceſſary methods for preſerving his life. Philip the Acarnanian alone preſerved temper enough to examine the nature of the king's diſeaſe; the worſt ſymptom of which was a continual waking, and which he took off by means of a potion, and in a ſhort time the king recovered his uſual health.

80 Tyre taken and deſtroyed.

Soon after Alexander's recovery, he received the agreeable news that Ptolemy and Aſander had defeated the Perſian generals, and made great conqueſts on the Helleſpont; a little after that, he met the Perſian army at Iſſus, commanded by Darius himſelf. A bloody engagement enſued, in which the Perſians were defeated with great ſlaughter, as related under the article Issus. The conſequences of this victory were very advantageous to the Macedonians. Many governors of provinces and petty princes ſubmitted themſelves to the conqueror; and ſuch as did ſo were treated not as a newly-conquered people, but as his old hereditary ſubjects; being neither burthened with ſoldiers nor oppreſſed with tribute. Among the number of thoſe places which, within a ſhort ſpace after the battle of Iſſus, ſent deputies to ſubmit to the conqueror, was the city of Tyre. The king, whoſe name was Azelmicus, was abſent in the Perſian fleet; but his ſon was among the deputies, and was very favourably received by Alexander. The king probably intended to confer particular honours on the city of Tyre; for he acquainted the inhabitants that he would come and ſacrifice to the Tyrian Hercules, the patron of their city, to whom they had erected a moſt magnificent temple. But theſe people, like moſt other trading nations, were too ſuſpicious to think of admitting ſuch an enterpriſing prince with his troops within their walls. They ſent therefore the deputies again to him, to inform him, that they were ready to do whatever he ſhould command them; but, as to his coming and ſacrificing in their city, they could not conſent to that, but were poſitively determined not to admit a ſingle Macedonian within their gates. Alexander immediately diſmiſſed their deputies in great diſpleaſure. He then aſſembled a council of war, wherein he inſiſted ſtrongly on the diſaffected ſtate of Greece, (for moſt of the Grecian ſtates had ſent ambaſſadors to Darius, to enter into a league with him againſt the Macedonians), the power of the Perſians by ſea, and the folly of carrying on the war in diſtant provinces, while Tyre was left unreduced behind them: he alſo remarked, that if once the city was ſubdued, the ſovereignty of the ſea would be transferred to them, becauſe it would fix their poſſeſſion of the coaſts; and as the Perſian fleet was compoſed chiefly of tributary ſquadrons, thoſe tributaries would fight the battles, not of their late but of their preſent maſters. For theſe reaſons the ſiege of Tyre was reſolved on. The town was not taken, however, without great difficulty; which provoked Alexander to ſuch a degree, that he treated the inhabitants with the greateſt cruelty. See Tyre.

After the reduction of Tyre, Alexander, though the ſeaſon was already far advanced, reſolved to make an expedition into Syria; and in his way thither propoſed to chaſtiſe the Jews, who had highly offended him during the ſiege of Tyre: for when he ſent to them to demand proviſions for his ſoldiers, they anſwered, That they were the ſubjects of Darius, and bound by an oath not to ſupply his enemies. The king, however, was pacified by their ſubmiſſion; and not only pardoned them, but conferred many privileges upon them, as related under the article Jews.

81
Egypt ſubmits.

From Jeruſalem, Alexander marched directly to Gaza, the only place in that part of the world which ſtill held out for Darius. This was a very large and ſtrong city, ſituated on an high hill, about five miles from the ſea ſhore. One *Batis*, or *Betis*, an eunuch, had the government of the place; and had made every preparation neceſſary for ſuſtaining a long and obſtinate ſiege. The governor defended the place with great valour, and ſeveral times repulſed his enemies: but at laſt it was taken by ſtorm, and all the garriſon ſlain to a man: and this ſecured to Alexander an entrance into Egypt, which having before been very impatient of the Perſian yoke, admitted the Macedonians peaceably.

82
Alexander viſits the temple of Jupiter Ammon.

Here the king laid the foundations of the city of Alexandria, which for many years after continued to be the capital of the country. While he remained here, he alſo formed the extraordinary deſign of viſiting the temple of Jupiter Ammon. As to the motives by which he was induced to take this extraordinary journey, authors are not agreed; but certain it is, that he hazarded himſelf and his troops in the higheſt degree, there being two dangers in this march, which, with the example of Cambyſes, who loſt the greateſt part of his army in it, might have terrified any body but Alexander. The firſt was the want of water, which, in the ſandy deſarts ſurrounding the temple, is no where to be found; the other, the uncertainty of the road from the fluctuation of the ſands; which changing their ſituation every moment, leave the traveller neither a road to walk in nor mark to march by. Theſe difficulties, however, Alexander got over, though not without a miraculous interpoſition, as is pretended by all his hiſtorians.

Alexander having conſulted the oracle, and received a favourable anſwer, returned to purſue his conqueſts. Having ſettled the government of Egypt, he appointed the general rendezvous of his forces at Tyre. Here he met with ambaſſadors from Athens, requeſting him to pardon ſuch of their countrymen as he found ſerving the enemy. The king, being deſirous to oblige ſuch a famous ſtate, granted their requeſt; and ſent alſo a fleet to the coaſt of Greece, to prevent the effects of ſome commotions which had lately happened in Peloponneſus. He then directed his march to Thapſacus; and having paſſed the Euphrates and Tigris met with Darius near Arbela, where the Perſians were again overthrown with prodigious ſlaughter †, and Alexander in effect became maſter of the Perſian empire.

83
Reduces Babylon, Suſa, and Perſepolis.

After this important victory, Alexander marched directly to Babylon, which was immediately delivered up; the inhabitants being greatly diſaffected to the Perſian intereſt. After 30 days ſtay in this country, the king marched to Suſa, which had already ſurrendered to Philoxenus; and here he received the treaſures of the Perſian monarch, amounting, according to the moſt generally received account, to 50,000 talents. Having received alſo at this time a ſupply of 6000 foot and 500 horſe from Macedon, he ſet about reducing the nations of Media, among whom Darius was retired. He firſt reduced the Uxians: and having forced a paſſage to Perſepolis the capital of the empire, he like a barbarian deſtroyed the ſtately palace there, a pile of building not to be equalled in any part of the world; after having given up the city to be plundered by his ſoldiers. In the palace he found 120,000 talents, which he appropriated to his own uſe, and cauſed immediately to be carried away upon mules and camels; for he had ſuch an extreme averſion to the inhabitants of Perſepolis, that he determined to leave nothing valuable in the city.

84
He purſues Darius.

During the time that Alexander remained at Perſepolis, he received intelligence that Darius remained at Ecbatana the capital of Media; upon which he purſued him with the greateſt expedition, marching at the rate of near 40 miles a-day. In 15 days he reached Ecbatana, where he was informed that Darius had retired from thence five days before, with an intent to paſs into the remoteſt provinces of his empire. This put ſome ſtop to the rapid progreſs of the Macedonian army; and the king perceiving that there was no neceſſity for hurrying himſelf and his ſoldiers in ſuch a manner, began to give the orders requiſite in the preſent ſituation of his affairs. The Theſſalian horſe, who had deſerved exceedingly well of him in all his battles, he diſmiſſed according to his agreement; gave them their whole pay, and ordered 2000 talents over and above to be diſtributed among them. He then declared that he would force no man: but if any were willing to ſerve him longer for pay, he deſired they would enter their names in a book, which a great many of them did; the reſt ſold their horſes, and prepared for their departure. The king appointed Epocillus to conduct them to the ſea, and aſſigned him a body of horſe as an eſcort: he likewiſe ſent Menetes with them, to take care of their embarkation, and that they were ſafely landed in Eubœa without any expence to themſelves.

On receiving freſh information concerning the ſtate of Darius's affairs, the king ſet out again in purſuit of him, advancing as far as Rhages, a city one day's journey from the Caſpian ſtraits: there he underſtood that Darius had paſſed thoſe ſtraits ſome time before; which information leaving him again without hopes, he halted for five days. Oxidates, a Perſian, whom Darius had left priſoner at Suſa, was made governor of Media, while the king departed on an expedition into Parthia. The Caſpian ſtraits he paſſed immediately without oppoſition; and then gave directions to his officers to collect a quantity of proviſions ſufficient to ſerve his army on a long march through a waſted country. But before his officers could accompliſh thoſe commands, the king received intelligence that Darius had been murdered by Beſſus, one of his own ſubjects, and governor of Bactria, as is related at length under the article Persia.

85
Who is murdered.

36
Alexander reduces Hyrcania.

As ſoon as Alexander had collected his forces together, and ſettled the government of Parthia, he entered Hyrcania; and having, according to his uſual cuſtom, committed the greateſt part of his army to the care of Craterus, he, at the head of a choice body of troops, paſſed through certain craggy roads,

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† See *Arbela*.

and before the arrival of Craterus, who took an open and eaſy path, ſtruck the whole province with ſuch terror, that all the principal places were immediately put into his hands, and ſoon after the province of Aria alſo ſubmitted, and the king continued Satibarzanes the governor in his employment.—The reduction of this province finiſhed the conqueſt of Perſia; but the ambition of Alexander to become maſter of every nation of which he had the leaſt intelligence, induced him to enter the country of the *Mardi*, merely becauſe its rocks and barrenneſs had hitherto hindered any body from conquering, or indeed from attempting to conquer it. This conqueſt, however, he eaſily accompliſhed, and obliged the whole nation to ſubmit to his pleaſure. But in the mean time diſturbances began to ariſe in Alexander's new empire, and among his troops, which all his activity could not thoroughly ſuppreſs. He had ſcarcely left the province of Aria, when he received intelligence, that the traitor Beſſus had cauſed himſelf to be proclaimed king of Aſia by the name of *Artaxerxes*; and that Satibarzanes had joined him, after having maſſacred all the Macedonians who had been left in the province. Alexander appointed one *Arſames* governor in the room of Satibarzanes; and marched thence with his army againſt the *Zorangæ*, who under the command of Barzaentes, one of thoſe who had conſpired againſt Darius, had taken up arms, and threatened to make an obſtinate defence. But their numbers daily falling off, Barzaentes being afraid they would purchaſe their own ſafety at the expence of his, privately withdrew from his camp, and, croſſing the river Indus, ſought ſhelter among the nations beyond it. But they, either dreading the power of Alexander, or deteſting the treachery of this Perſian towards his former maſter, ſeized and delivered him up to Alexander, who cauſed him immediately to be put to death.

87 The Macedonians give themſelves up to luxury. The immenſe treaſure which the Macedonians had acquired in the conqueſt of Perſia began now to corrupt them. The king himſelf was of a moſt generous diſpoſition, and liberally beſtowed his gifts on thoſe around him; but they made a bad uſe of his bounty, and fooliſhly indulged in thoſe vices by which the former poſſeſſors of that wealth had loſt it. The king did all in his power to diſcourage the lazy and inactive pride which now began to ſhew itſelf among his officers; but neither his diſcourſes nor his example had any conſiderable effect. The manners of his courtiers from bad became worſe, in ſpite of all he could ſay or do to prevent it; and at laſt they proceeded to cenſure his conduct, and to expreſs themſelves with ſome bitterneſs on the ſubject of his long continuance of the war, and his leading them conſtantly from one labour to another. This came to ſuch an height, that the king was at laſt obliged to uſe ſome ſeverity in order to keep his army within the limits of their duty.—
88 Alexander conforms to the Perſian cuſtoms. From this time forward, however, Alexander himſelf began to alter his conduct; and by giving a little into the cuſtoms of the Orientals, endeavoured to ſecure that obedience from his new ſubjects which he found ſo difficult to be preſerved among his old ones. He likewiſe endeavoured, by various methods to blend the cuſtoms of the Aſiatics and the Greeks. The form of his civil government reſembled that of the ancient Perſian kings; in the military affairs, however, he preſerved the Macedonian diſcipline; but then he made choice of 30,000 boys out the provinces, whom he cauſed to be inſtructed in the Greek language, and directed to be brought up in ſuch a manner as that from time to time he might with them fill up the phalanx. The Macedonians ſaw with great concern theſe extraordinary meaſures, which ſuited very ill with their groſs underſtandings; for they thought, after all the victories they had gained, to be abſolute lords of Aſia, and to poſſeſs not only the riches of its inhabitants, but to rule the inhabitants themſelves: whereas they now ſaw, that Alexander meant no ſuch thing; but that, on the contrary, he conferred governments, offices at court, and all other marks of confidence and favour, indiſcriminately both on Greeks and Perſians.—From this time alſo the king ſeems to have given inſtances of a cruelty he had never ſhewn before. Philotas his moſt intimate friend was ſeized, tortured, and put to death for a conſpiracy of which it could never be proved that he was guilty; and ſoon after Parmenio and ſome others were executed without any crime at all real or alleged. Theſe things very much diſturbed the army. Some of them wrote home to Macedonia of the king's ſuſpicions of his friends, and his diſpoſition to hunt out enemies at the very extremities of the world. Alexander having intercepted ſome of theſe letters, and procured the beſt information he could concerning their authors, picked out theſe diſſatisfied people, and having diſpoſed them into one corps, gave it the title of the *turbulent battalion*; hoping by this means to prevent the ſpirit of diſaffection from pervading the whole army.

As a farther precaution againſt any future conſpiracy, Alexander thought fit to appoint Hepheſtion and Clytus, generals of the auxiliary horſe; being apprehenſive, that if this authority was lodged in the hands of a ſingle perſon, it might prompt him to dangerous undertakings, and at the ſame time furniſh him with the means of carrying them into execution. To keep his forces in action, he ſuddenly marched into the country of the Euergetæ, i. e. *Benefactors*; and found them full of that kind and hoſpitable diſpoſition for which that name had been beſtowed on their anceſtors: he therefore treated them with great reſpect; and at his departure added ſome lands to their dominions, which lay contiguous, and which for that reaſon they had requeſted of him.

Turning then to the eaſt, he entered Arachoſia, the inhabitants of which ſubmitted without giving him any trouble. While he paſſed the winter in theſe parts, the king received advice, that the Arians, whom he had ſo lately ſubdued, were again up in arms, Satibarzanes being returned into that country with two thouſand horſe aſſigned him by Beſſus. Alexander inſtantly diſpatched Artabazus the Perſian, with Erigyus and Caranus, two of his commanders, with a conſiderable body of horſe and foot: he likewiſe ordered Phrataphernes, to whom he had given the govern-
ment of Parthia, to accompany them. A general engagement enſued, wherein the Arians behaved very well, as long as their commander Satibarzanes lived; but he engaging Erigyus, the Macedonian ſtruck him firſt into the throat, and then drawing forth his ſpear again, through the mouth; ſo that he immediately 89 Satibarzanes defeated and killed.

mediately expired, and with him the courage of his ſoldiers, who inſtantly began to fly; whereupon Alexander's commanders made an eaſy conqueſt of the reſt of the country, and ſettled it effectually under his obedience.

The king, notwithſtanding the inclemency of the ſeaſon, advanced into the country of Paropamiſus, ſo called from the mountain Paropamiſus, which the ſoldiers of Alexander called *Caucaſus*. Having croſſed the country in 16 days, he came at length to an opening leading into Media; which finding of a ſufficient breadth, he directed a city to be built there, which he called *Alexandria*, as alſo ſeveral other towns about a day's journey diſtant from thence; and in theſe places he left 7000 perſons, part of them ſuch as had hitherto followed his camp, and part of the mercenary ſoldiers, who, weary of continual fatigue, were content to dwell there. Having thus ſettled things in this province, ſacrificed ſolemnly to the gods, and appointed Proexes the Perſian, preſident thereof, with a ſmall body of troops under the command of Niloxenus to aſſiſt him, he reſumed his former deſign of penetrating into Bactria.

90
Beſſus reduced and put to death.

Beſſus, who had aſſumed the title of *Artaxerxes*, when he was aſſured that Alexander was marching towards him, immediately began to waſte all the country between Paropamiſus and the river Oxus; which river he paſſed with his forces, and then burnt all the veſſels he had made uſe of for tranſporting them, retiring to Nautaca, a city of Sogdia; fully perſuaded, that, by the precautions he had taken, Alexander would be compelled to give over his purſuit. This conduct of his, however, diſheartened his troops, and gave the lie to all his pretenſions; for he had affected to cenſure Darius's conduct, and had charged him with cowardice, in not defending the rivers Euphrates and Tigris, whereas he now quitted the banks of the moſt defenſible river perhaps in the whole world. As to his hopes, tho' it cannot be ſaid they were ill founded, yet they proved abſolutely vain; for Alexander, continuing his march, notwithſtanding all the hardſhips his ſoldiers ſuſtained, reduced all Bactria under his obedience, particularly the capital Bactria, and the ſtrong caſtle Aornus: in the latter he placed a garriſon under the command of Archelaus; but the government of the province he committed to Artabazus. He then continued his march to the river Oxus: on the banks of which when he arrived, he found it three quarters of a mile over, its depth more than proportionable to its breadth, its bottom ſandy, its ſtream ſo rapid as to render it almoſt unnavigable, and neither boat nor tree in its neighbourhood; ſo that the ableſt commanders in the Macedonian army were of opinion that they ſhould be obliged to march back. The king, however, having firſt ſent away, under a proper eſcort, all his infirm and worn-out ſoldiers, that they might be conducted ſafe to the ſea-ports, and from thence to Greece, deviſed a method of paſſing this river without either boat or bridge, by cauſing the hides which covered the ſoldiers tents and carriages to be ſtuffed with ſtraw, and then tied together, and thrown into the river. Having croſſed the Oxus, he marched directly towards the camp of Beſſus, where when he arrived, he found it abandoned; but received at the ſame time letters from Spitamenes and Dataphernes, who were the chief commanders under Beſſus, ſignifying, that, if he would ſend a ſmall party to receive Beſſus, they would deliver him into his hands; which they did accordingly, and the traitor was put to death in the manner related in the hiſtory of PERSIA.

A ſupply of horſes being now arrived, the Macedonian cavalry were remounted. Alexander continued his march to Maracanda, the capital of Sogdia, from whence he advanced to the river Iaxartes. Here he performed great exploits againſt the Scythians; from whom, however, though he overcame them, his army ſuffered much; and the revolted Sogdians being headed by Spitamenes, gave him a great deal of trouble. Here he married Roxana the daughter of Oxyartes, a prince of the country whom he had ſubdued. But during theſe expeditions, the king greatly diſguſted his army by the murder of his friend Clytus in a drunken quarrel at a banquet, and by his extravagant vanity in claiming divine honours.

91
Alexander marries Roxana

92
Paſſes the Indus.

At laſt he arrived at the river Indus, where Hephæſtion and Perdiccas had already provided a bridge of boats for the paſſage of the army. The king refreſhed his troops for 30 days in the countries on the other ſide of the river, which were thoſe of his friend and ally Taxiles, who gave him 30 elephants, and joined his army now with 700 Indian horſe, to which, when they were to enter upon action, he afterwards added 5000 foot. The true reaſon of this ſeems to have been his enmity to Porus, a famous Indian prince, whoſe territories lay on the other ſide of the river Hydaſpes. During this receſs, the king ſacrificed with great ſolemnity; receiving alſo ambaſſadors from Ambiſurus, a very potent prince, and from Doxarcas, who was likewiſe a king in thoſe parts, with tenders of their duty, and conſiderable preſents. Theſe ceremonies over, Alexander appointed Philip governor of Taxila, and put a Macedonian garriſon into the place, becauſe he intended to erect an hoſpital there for the cure of his ſick and wounded ſoldiers. He then ordered the veſſels, of which his bridge had been compoſed when he paſſed the Indus, to be taken to pieces, that they might be brought to the Hydaſpes, where he was informed that Porus with a great army lay encamped to hinder his paſſage. When he approached the banks of this river with his army and the auxiliaries under the command of Taxiles, he found that the people he had to do with were not ſo eaſily to be ſubdued as the Perſians and other Aſiatics. The Indians were not only a very tall and robuſt, but alſo a very hardy and well-diſciplined people; and their king Porus was a prince of high ſpirit, invincible courage, and great conduct.

It was about the ſummer ſolſtice when Alexander reached the Hydaſpes, and conſequently its waters were broader, deeper, and more rapid, than at any other time; for in India the rivers ſwell as the ſun's increaſing heat melts the ſnow, and ſubſide again as winter approaches. Alexander therefore had every difficulty to ſtruggle with. Porus had made his diſpoſitions ſo judiciouſly, that Alexander found it impoſſible to practiſe upon him as he had done upon others, and to paſs the river in his view: wherefore he was conſtrained to divide his army into ſmall parties, and to practiſe other arts, in order to get the better of ſo vigilant a prince. To this end he cauſed a great quantity of corn and other proviſions to be brought into his camp, giving out, that he intended to remain where he was till the river fell, and by becoming fordable ſhould give him an opportunity of forcing a paſſage: this did not, however, hinder Porus from keeping up very ſtrict diſcipline in his camp; which when Alexander perceived, he frequently made ſuch motions as ſeemed to indicate a change of his reſolution, and that he had ſtill thoughts of paſſing the river. The main thing the Macedonians ſtood in fear of were the elephants; for the bank being pretty ſteep on the other ſide, and it being the nature of horſes to ſtart at the firſt appearance of thoſe animals, it was foreſeen that the army would be diſordered and incapable of ſuſtaining the charge of Porus's troops.

93
And the Hydaſpes with difficulty.

At length Alexander paſſed the river by the following contrivance. There was, at the diſtance of 150 ſtadia from his camp, a rocky promontory projecting into the river, thick covered with wood; and overagainſt this promontory there lay a pretty large uninhabited iſland almoſt overgrown with trees. The king therefore conceived within himſelf a project of conveying a body of troops from this promontory into that iſland; and upon this ſcheme he built his hopes of ſurpriſing Porus, vigilant as he was. To this end he kept him and his army conſtantly alarmed for many nights together, till he perceived that Porus apprehended it was only done to haraſs his troops, and therefore no longer drew out of his camp, but truſted to his ordinary guards: then Alexander reſolved to put his deſign in execution. A conſiderable body of horſe, the Macedonian phalanx, with ſome corps of light armed foot, he left in his camp under the command of Craterus, as alſo the auxiliary Indians; giving theſe orders to be obſerved in his abſence, that if Porus marched againſt him with part of his army and left another part with the elephants behind in his camp, Craterus and his forces ſhould remain where they were; but if it ſo happened that Porus withdrew his elephants, then Craterus was to paſs the river, becauſe his cavalry might then do it ſafely. Alexander having marched half the way, or about nine of our miles, ordered the mercenary troops under the command of Attalus and other generals, to remain there; and directed them, that as ſoon as he knew he was engaged with the Indians on the other ſide, they ſhould paſs in veſſels provided for that purpoſe, in order to aſſiſt him. Then marching a long way about, that the enemy might not perceive his deſign of reaching the rock, he advanced as diligently as he could towards that poſt. It happened very fortunately for him, that a great ſtorm of thunder, lightning, and hail, roſe in the night, whereby his march was perfectly concealed, his veſſels of 30 oars put together, and his tents ſtuffed and ſtitched, ſo that they paſſed from the rock into the iſland, without being perceived, a little before break of day; the ſtorm ceaſing juſt as he and his ſoldiers were ready for their paſſage. When they had traverſed the iſland, they boldly ſet forward to gain the oppoſite ſhore in ſight of Porus's out-guards, who inſtantly poſted away to give their maſter an account of the attempt. Alexander landed firſt himſelf, and was followed as expeditiouſly as poſſible by his forces, whom he took care to draw up as faſt as they arrived. When they began their march again, they found that their good fortune was not ſo great as at firſt they eſteemed it; for it appeared now, that they had not reached the continent at all, but were in truth in another iſland much larger than the former. They croſſed it as faſt as they could, and found that it was divided from the *terra firma* by a narrow channel, which, however, was ſo ſwelled by the late heavy rain, that the poor ſoldiers were obliged to wade up to the breaſt. When they were on the other ſide, the king drew them up again carefully, ordering the foot to march ſlowly, they being in number about 6000, while himſelf with 5000 horſe advanced before. As ſoon as Porus received intelligence that Alexander was actually paſſing the river, he ſent his ſon with 2000 horſe, and 120 armed chariots, to oppoſe him. But they came too late: Alexander was already got on ſhore, and even on his march.

94
The ſon of Porus defeated and killed.

When the Macedonian ſcouts perceived them advance, they informed the king, who ſent a detachment to attack them, remaining ſtill at the head of his cavalry in expectation of Porus. But when he found that this party was unſupported, he inſtantly attacked with all his horſe, and defeated them with the ſlaughter of many, and the loſs of all their armed chariots, the ſon of Porus being ſlain in the fight. The remainder of the horſe returning to the camp with this diſaſtrous account, Porus was in ſome confuſion: however, he took very quickly the beſt and wiſeſt reſolutions his circumſtances would allow; which were, to leave a part of his army, with ſome of his elephants, to oppoſe Craterus, who was now about to paſs the river alſo; and, with the reſt, to march againſt Alexander and his forces, who were already paſſed. This reſolution once taken, he marched immediately out of his camp, at the head of 4000 horſe, 30,000 foot, 300 chariots, and 200 elephants. He advanced as expeditiouſly as he could, till he came into a plain which was firm and ſandy, where his chariots and elephants might act to advantage: there he halted, that he might put his army in order, knowing well that he need not go in queſt of his enemy. Alexander ſoon came up with his horſe, but he did not charge Porus; on the contrary, he halted, and put his troops in order, that they might be able to defend themſelves in caſe they were attacked. When he had waited ſome time, his foot arrived; whom he immediately ſurrounded with his horſe, that, after ſo fatiguing a march, they might have time to cool and breathe themſelves, before they were led to engage. Porus permitted all this, becauſe it was not his intereſt to fight, and becauſe he depended chiefly upon his order of battle, the elephants covering his foot, ſo that the Macedonians could not charge them.

95
Porus himſelf defeated.

When Alexander had diſpoſed his foot in proper order, he placed his horſe on the wings: and, obſerving that he was much ſuperior in them to the enemy, and that the cavalry of Porus were eaſy to be charged, he reſolved to let the foot have as little ſhare as poſſible in the battle. To this end, having given the neceſſary directions to Cœnas who commanded them, he went himſelf to the right, and with great fury fell upon the left wing of Porus. The diſpute, though ſhort, was very bloody: the cavalry of Porus though they fought gallantly were quickly broken; and the foot being by this means uncovered, the Macedonians charged them. But the Indian horſes rallying, came up to their relief, yet were again defeated. By this time the archers had wounded many of the elephants, and killed moſt of their riders, ſo that they did not prove leſs troubleſome and dangerous to their own ſide than to the Macedonians; whence a great confuſion enſued: and Cœnus, taking this opportunity, fell in with the troops under his command, and entirely defeated the Indian army. Porus himſelf behaved with the greateſt intrepidity, and with the moſt excellent conduct: he gave his orders, and directed every thing, as long as his troops retained their form; and when they were broken, he retired from party to party as they made ſtands, and continued fighting till every corps of Indians was put to the rout. In the mean time Craterus had paſſed with the reſt of the Macedonian army; and theſe, falling upon the flying Indians, increaſed the ſlaughter of the day exceſſively, inſomuch that 20,000 foot 3000 horſe were killed, all the chariots were hacked to pieces, and the elephants not killed were taken: two of Porus's ſons fell here, as alſo moſt of his officers of all ranks.

66
He ſubmits to Alexander.

As for Porus, Alexander gave ſtrict directions that no injury might be done to his perſon: he even ſent Taxiles to perſuade him to ſurrender himſelf, and to aſſure him that he ſhould be treated with all the kindneſs and reſpect imaginable; but Porus, diſdaining this advice from the mouth of an old enemy, threw a javelin at him, and had killed him but for the quick turn of his horſe. Meroe the Indian, who was alſo in the ſervice of Alexander, ſucceeded better: he had been the old acquaintance of Porus; and therefore when he intreated that prince to ſpare his perſon, and to ſubmit himſelf to fortune and a generous victor, Porus followed his advice; and we may truly ſay, that the condition of this Indian king ſuffered nothing by the loſs of the battle. Alexander immediately gave him his liberty, reſtored him ſhortly after to his kingdom, to which he annexed provinces almoſt equal to it in value. Neither was Alexander a loſer by his munificence; for Porus remained his true friend and conſtant ally.

To perpetuate the memory of this victory, Alexander ordered two cities to be erected; one on the field of battle, which he named *Nicæa*; the other on this ſide the river, which he called *Bucephala*, in honour of his horſe Bucephalus, who died here, as Arrian ſays, of mere old age, being on the verge of 30. All the ſoldiers, who fell in battle, he buried with great honours; offered ſolemn ſacrifices to the gods, and exhibited pompous ſhows on the banks of the Hydaſpes, where he had forced his paſſage. He then entered the territories of the Glaucæ, in which were 37 good cities, and a multitude of populous villages. All theſe were delivered up to him without fighting; and as ſoon as he received them, he preſented them to Porus; and having reconciled him to Taxiles, he ſent the latter home to his own dominions. About this time ambaſſadors arrived from ſome Indian princes with their ſubmiſſions; and Alexander having conquered the dominions of another Porus, which lay on the Hydraotes a branch of the Indus, added them to thoſe of Porus his ally.

97
Sangala taken.

In the midſt of all this ſucceſs, however, news arrived, that the Cathei, the Oxydracæ, and the Malli, the moſt warlike nations of India, were confederated againſt the Macedonians, and had drawn together a great army. The king immediately marched to give them battle; and in a few days reached a city called *Sangala*, ſeated on the top of a hill, and having a fine lake behind it. Before this city the confederate Indians lay encamped, having three circular lines of carriages locked together, and their tents pitched in the centre. Notwithſtanding the apparent difficulty of forcing theſe entrenchments, Alexander reſolved immediately to attack them. The Indians made a noble defence; but at laſt the firſt line of their carriages was broken, and the Macedonians entered. The ſecond was ſtronger by far; yet Alexander attacked that too, and after a deſperate reſiſtance forced it. The Indians without truſting to the third, retired into the city; which Alexander would have inveſted: but the foot he had with him not being ſufficient for that purpoſe, he cauſed his works to be carried on both ſides as far as the lake; and, on the other ſide of that, ordered ſeveral brigades of horſe to take poſt; ordering alſo battering engines to be brought up, and in ſome places employing miners. The ſecond night he received intelligence that the beſieged, knowing the lake to be fordable, intended to make their eſcape through it. Upon this the king ordered all the carriages which had been taken in forcing their camp to be placed up and down the roads, in hopes of hindering their flight; giving directions to Ptolemy, who commanded the horſe on the other ſide of the lake, to be extremely vigilant, and to cauſe all his trumpets to ſound, that the forces might repair to that poſt where the Indians made their greateſt effort. Theſe precautions had all the effect that could be deſired: for of the few Indians who got through the lake, and paſſed the Macedonian horſe, the greater part were killed on the roads; but the greateſt part of their army was conſtrained to retire again through the water into the city. Two days after the place was taken by ſtorm. Seventeen thouſand Indians were killed 70,000 taken priſoners; with 300 chariots, and 500 horſe. The Macedonians are ſaid to have loſt only 100 men in this ſiege; but they had 1200 wounded, and among theſe ſeveral perſons of great diſtinction.

93
And raſed.

The city was no ſooner taken, than Alexander diſpatched Eumenes his ſecretary, with a party of horſe, to acquaint the inhabitants of the cities adjacent with what had befallen the Sangalans; promiſing alſo, that they ſhould be kindly treated if they would ſubmit. But they were ſo much affrighted at what had happened to their neighbours, that, abandoning all their cities, they fled into the mountains, chooſing rather to expoſe themſelves to wild beaſts, than to theſe invaders, who had treated their countrymen ſo cruelly. When the king was informed of this, he ſent detachments of horſe and foot to ſcour the roads; and theſe, finding aged, infirm, and wounded people, to the number of about 500, put them to the ſword without mercy. Perceiving that it was impoſſible to perſuade the inhabitants to return, he cauſed the city of Sangala to be raſed, and gave the territories to the few Indians who had ſubmitted to him.

Alexander, ſtill unſated with conqueſt, now prepared to paſs the Hyphaſis. The chief reaſon which induced him to think of this expedition was, the information he had received of the ſtate of the countries beyond that river. He was told that they were in themſelves rich and fruitful; that their inhabitants were not only a very martial people, but very civilized, that they were governed by the nobility, who were themſelves ſubject to the laws; and that as they lived in happineſs and freedom, it was likely they would fight obſtinately in defence of thoſe bleſſings. He was farther told, that among theſe nations there were the largeſt, ſtrongeſt, and moſt uſeful elephants bred and tamed; and was therefore fired with an earneſt deſire to reduce ſuch a bold and brave people under his rule, and of attaining to the poſſeſſion of the many valuable things that were ſaid to be amongſt them. As exorbitant, however, as his perſonal ambition was, he found it impoſſible to infuſe any part of it into the minds of his ſoldiers; who were ſo far from wiſhing to triumph over new and remote countries, that they were highly deſirous of leaving thoſe that they had already conquered.

99
Alexander's troops refuſe to proceed further.

When therefore they were informed of the king's intentions, they privately conſulted together in the camp about the ſituation of their own affairs. At this conſultation, the graveſt and beſt of the ſoldiers lamented that they were made uſe of by their king, not as lions, who fall fiercely upon thoſe who have injured them; but as maſtiffs, who fly upon and tear thoſe who are pointed out to them as enemies. The reſt were not ſo modeſt; but expreſſed themſelves roundly againſt the king's humour for leading them from battle to battle, from ſiege to ſiege, and from river to river; proteſting that they would follow him no further, nor laviſh away their lives any longer, to purchaſe fame for him.

Alexander was a man of too much penetration not to be early in perceiving that his troops were very uneaſy. He therefore harangued them from his tribunal; but though his eloquence was great, and the love his army had for him was yet very ſtrong, they did not relent. For ſome time the ſoldiers remained ſullen and ſilent; and at laſt turned their eyes on Cœnus, an old and experienced general, whom Alexander loved, and in whom the army put great confidence.—He had the generoſity to undertake their cauſe; and told Alexander frankly, "that men endured toil in hopes of repoſe; that the Macedonians were already much reduced in their numbers; that of thoſe who remained, the greater part were invalids; and that they expected, in conſideration of their former ſervices, that he would now lead them back to their native country: an act, which of all others, would moſt contribute to his own great deſigns; ſince it would encourage the youth of Macedon, and even of all Greece, to follow him in whatever new expedition he pleaſed to undertake." The king was far from being pleaſed with this ſpeech of Cœnus, and much leſs with the diſpoſition of his army, which continued in a deep ſilence. He therefore diſmiſſed the aſſembly: but next day he called another, wherein he told the ſoldiers plainly, that he would not be driven from his purpoſe; that he would proceed in his conqueſts with ſuch as would follow him voluntarily: as for the reſt, he would not detain them, but would leave them at liberty to go home to Macedon, where they might publiſh, "that they had left their king in the midſt of his enemies." Even this expedient had no ſucceſs; his army was ſo thoroughly tired with long marches and deſperate battles, that they were determined to go no farther, either for fair ſpeeches or foul. Upon this Alexander retired to his tent, where he refuſed to ſee his friends, and put on the ſame gloomy temper that reigned among his troops. For three days things remained in this ſituation. At laſt the king ſuddenly appeared; and, as if he had been fully determined to purſue his firſt deſign, he gave orders for ſacrificing for the good ſucceſs of his new undertaking. Ariſtander the augur reported, that the omens were altogether inauſpicious; upon which the king ſaid, that ſince his proceeding farther was neither pleaſing to the gods nor grateful to his army, he would return.

100
He conſents to return.

When this was rumoured among the army, they aſſembled in great numbers about the royal tent, ſaluting the king with loud acclammations, wiſhing him ſucceſs in all his future deſigns; giving him at the ſame time hearty thanks, for that "he who was invincible had ſuffered himſelf to be overcome by their prayers."

A ſtop being thus put to the conqueſts of Alexander, he determined to make the Hyphaſis the boundary of his dominions; and having erected twelve altars of an extraordinary magnitude, he ſacrificed on them: after which, he exhibited ſhows in the Grecian manner; and, having added all the conquered country in theſe parts to the dominions of Porus, he began to return.

101
Sails down the Indus.

Having arrived at the Hydaſpes, he made the neceſſary preparations for ſailing down the Indus into the ocean. For this purpoſe he ordered vaſt quantities of timber to be felled in the neighbourhood of the Hydaſpes, through which he was to ſail into the Indus; he cauſed the veſſels with which he had paſſed other rivers to be brought thither, and aſſembled a vaſt number of artificers capable of repairing and equipping his fleet; which, when finiſhed, conſiſted of 80 veſſels of three banks of oars, and 2000 leſſer ſhips and tranſports. Thoſe who were to manage this fleet were collected out from the Phœnicians, Cyprians, Carians, and Egyptians following his army, and who were reckoned perfectly well ſkilled in the naval art. When all things were ready, the army embarked about break of day; the king, in the mean time, ſacrificing to the gods according to the ceremonies uſed in his own country, and likewiſe according to thoſe of the country where he now was. Then he himſelf went on board, and cauſing the ſignal to be given by ſound of trumpet, the fleet ſet ſail. Craterus and Hephæſtion had marched ſome days before with another diviſion of the army; and in three days the fleet reached that part of the river which was oppoſite to their camps. Here he had information, that the Oxydracæ and Malli were raiſing forces to oppoſe him: upon which he immediately determined to reduce them; for, during his voyage, he made it a rule to compel the inhabitants on both ſides of the river to yield him obedience. But before he arrived on the coaſts of the people abovementioned, he himſelf ſuſtained no ſmall danger; for, coming to the confluence of the Aceſines with the Hydaſpes, from whence both rivers roll together into the Indus, the eddies, whirlpools, and rapid currents, ruſhing with tremendous noiſe from the reſpective channels of thoſe rivers into the great one formed by them both, at once terrified thoſe who navigated his veſſels, and actually

tually deſtroyed many of the long veſſels, with all who were aboard of them; the king himſelf being in ſome danger, and Nearchus the admiral not a little at a loſs. As ſoon as this danger was over, Alexander went on ſhore; and having ordered his elephants with ſome troops of horſe and archers to be carried acroſs, and put under the command of Craterus, he then divided his army on the left-hand bank into three bodies; the firſt commanded by himſelf, the ſecond by Hyphæſtion, and the third by Ptolemy. Hyphæſtion had orders to move ſilently through the heart of the country, five days march before the king; that if, on Alexander's approach, any of the barbarians ſhould attempt to ſhelter themſelves by retiring into the country, they migh fall into the hands of Hyphæſtion. Ptolemy Lagus was ordered to march three days journey behind the king, that if any eſcaped his army, they might fall into Ptolemy's hands; and the fleet had orders to ſtop at the confluence of this river with the Hydraotes till ſuch time as theſe ſeveral corps ſhould arrive.

109
His expedition againſt the Malli.

Alexander himſelf, at the head of a body of horſe and light armed foot, marched through a deſart country againſt the Malli; and, ſcarce affording any reſt to his ſoldiers, arrived in three days at a city into which the barbarians had put their wives and children, with a good gariſon for their defence. The country people, having no notion that Alexander would march through ſuch a deſert and barren region, were all unarmed, and in the utmoſt confuſion. Many of them therefore were ſlain in the field; the reſt fled into the city, and ſhut the gates. But this only protracted their fate for a ſhort time; for the king, having ordered the city to be inveſted by his cavalry, took it, as well as the caſtle, by ſtorm, and put all he found there to the ſword. He ſent at the ſame time Perdiccas with a conſiderable detachment, to inveſt another city of the Malli at a conſiderable diſtance; but when he came there, he found it abandoned. However, he purſued the inhabitants who had but lately left it, and killed great numbers of them on the road. After this the king took ſeveral other cities, but not without conſiderable reſiſtance; for the Indians ſometimes choſe to burn themſelves in their houſes rather than ſurrender. At laſt he marched to their capital city; and finding that abandoned, he proceeded to the river Hydraotes, where he found 50,000 men encamped on the oppoſite bank, in order to diſpute his paſſage. He did not heſitate, however, to enter the river with a conſiderable party of horſe: and ſo much were the Indians terrified at his preſence, that their whole army retired before him. In a ſhort time they returned and attacked him, being aſhamed to fly before ſuch an inconſiderable number; but in the mean time the reſt of the Macedonian forces came up, and the Indians were obliged to retire to a city which lay behind them, and which Alexander inveſted that very night. The next day he ſtormed the city with ſuch violence, that the inhabitants were compelled to abandon it, and to retire to the caſtle, where they prepared for an obſtinate defence. The king inſtantly gave orders for ſcaling the walls, and the ſoldiers prepared to execute theſe orders as faſt as they could; but the king being impatient caught hold of a ladder and mounted it firſt himſelf, being followed by Leonatus, Peuceſtas, and Abreas, the latter a man of great valour, and who on that account had double pay allowed him. The king having gained the top of the battlements, cleared them quickly of the defendants, killing ſome of them with his ſword, and puſhing others over the walls: but after this was done, he was in more danger than ever; for the Indians galled him with their arrows from the adjacent towers, though they durſt not come near enough to engage him. His own battalion of targeteers mounting in haſte to ſecond him, broke the ladders; which, as ſoon as Alexander perceived, he threw himſelf down into the caſtle, as did alſo Peuceſtas, Leonatus, and Abreas. As ſoon as the king was on the ground, the Indian general ruſhed forward to attack him; but Alexander inſtantly diſpatched him, as well as ſeveral others who followed him. Upon this the reſt retired, and contented themſelves with throwing darts and ſtones at him at a diſtance. Abreas was ſtruck into the head with an arrow, and died on the ſpot; and, ſhortly after, another pierced through the king's breaſtplate into his body. As long as he had ſpirits, he defended himſelf valiantly; but through a vaſt effuſion of blood, loſing his ſenſes, he fell upon his ſhield. Peuceſtas then covered him with the ſacred ſhield of Pallas on one ſide, as did Leonatus with his own ſhield on the other, though they themſelves were dreadfully wounded. In the mean time, however, the ſoldiers on the outſide, eager to ſave their king, ſupplied their want of ladders by driving large iron pins into the walls. By the help of theſe many of them aſcended, and came to the aſſiſtance of Alexander and his companions. The Indians were now ſlaughtered without mercy; but Alexander continued for ſome time in a very dangerous way: however, he at laſt recovered his ſtrength, and ſhowed himſelf again to his army, which filled them with the greateſt joy.

103
His deſperate valour and danger

104
Is with difficulty ſaved by his men.

The Malli, being now convinced that nothing but ſubmiſſion could ſave the remainder of them, ſent deputies to Alexander, offering the dominion of their country; as did alſo the Oxydracæ: and the king having ſettled every thing in theſe countries agreeable to his mind, proceeded on his voyage down the river Indus. In this voyage he received the ſubmiſſion of ſome other Indian princes; and perceiving, that, at the point of the Iſland Pattala, the river divided itſelf into two vaſt branches, he ordered a haven and convenient docks to be made there for his ſhips; and when he had careened his fleet, he ſailed down the right-hand branch towards the ocean. In his paſſage he ſuſtained great difficulties by reaſon of his want of pilots, and at the mouth of the river very narrowly miſſed being caſt away: yet all this did not hinder him from purſuing his firſt deſign, though it does not appear that he had any other motive thereto than the vain deſire of boaſting that he had entered the ocean beyond the Indus: for, having conſecrated certain bulls to Neptune, and thrown them into the ſea, performed certain libations of golden cups, and thrown the cups alſo into the ſea, he came back again; having only ſurveyed two little iſlands, one at the mouth of the Indus, and one a little farther in the ocean.

105
He proceeds in his voyage down the Indus.

On the king's return to Pattala, he reſolved to ſail down the other branch of the Indus, that he might ſee whether it was more ſafe and commodious for his fleet than that which he had already tried; and for this he had very good reaſons. He had reſolved to ſend Nearchus with his fleet by ſea, through the Perſian gulf up the river Tygris, to meet him and his army in Meſopotamia; but as the poſſibility of this voyage depended on the ceaſing of the Eteſian winds, there was a neceſſity of laying up the fleet till the ſeaſon ſhould prove favourable. Alexander, therefore, ſailing through this branch of the Indus, ſought on the ſea-coaſt for bays and creeks, where his fleet might anchor in ſafety; he cauſed alſo pits to be ſunk, which might be filled with freſh water for the uſe of his people; and took all imaginable precautions for preſerving them in eaſe and ſafety till the ſeaſon would allow them to continue their voyage. In this he ſucceeded to his wiſh; for he found this branch of the river Indus, at its mouth, ſpread over the plain country and forming a kind of lake, wherein a fleet might ride with ſafety. He therefore appointed Leonatus, and a part of his army, to carry on ſuch works as were neceſſary; cauſing them to be relieved by freſh troops as often as there was occaſion: then having given his laſt inſtruction to Nearchus, he departed with the reſt of the army, in order to march back to Babylon.

106 Sets out for Babylon.

Before the king's departure, many of his friends adviſed him againſt the route which he intended to take. They told him, that nothing could be more raſh or dangerous than this reſolution. They acquainted him, that the country through which he was to travel was a wild uncultivated deſart; that Semiramis, when ſhe led her ſoldiers this way out of India, brought home but 20 of them; and that Cyrus, attempting to do the ſame, returned with only ſeven. But all this was ſo far from deterring Alexander, that it more than ever determined him to purſue no other road. As ſoon, therefore, as he had put things in order, he marched at the head of a ſufficient body of troops to reduce the Oritæ, who had never vouchſafed either to make their ſubmiſſion or to court his friendſhip. Their territories lay on the other ſide of a river called *Arabis*, which Alexander croſſed ſo ſpeedily, that they had no intelligence of his march; whereupon moſt of them quitted their country, and fled into the deſarts. Their capital he found ſo well ſituated, that he reſolved to take it out of their hands, and to cauſe a new and noble city to be founded there, the care of which he committed to Hephæſtion. Then he received the deputies of the Oritæ and Gedroſi; and having aſſured them, that if the people returned to their villages, they ſhould be kindly treated, and having appointed Apollophenes preſident of the Oritæ, and left a conſiderable body of troops under Leonatus to ſecure their obedience, he began his march through Gedroſia.

107 His dangerous march through Gedroſia,

In this march his troops ſuffered incredible hardſhips. The road was very uncertain and troubleſome, on account of its lying thro' deep and looſe ſands, riſing in many places into hillocks, which forced the ſoldiers to climb, at the ſame time that it ſunk under their feet; there were no towns, villages, nor places of refreſhment to be met with; ſo that, after exceſſive marches, they were forced to encamp among theſe dry ſands. As to proviſions, they hardly met with any during their whole march. The ſoldiers were therefore obliged to kill their beaſts of carriage: and ſuch as were ſent to bring ſome corn from the ſea-ſide, were ſo grievouſly diſtreſſed, that, though it was ſealed with the king's ſignet they cut open the bags, chooſing rather to die a violent death for diſobedience than periſh by hunger. When the king, however, was informed of this, he freely pardoned the offenders; he was alſo forced to accept the excuſes that were daily made for the loſs of mules, horſes, &c. which were in truth eaten by the ſoldiers, and their carriages broken in pieces to avoid further trouble. As for water their want of it was a great misfortune; and yet their finding it in plenty was ſometimes a greater: for, as by the firſt they periſhed with thirſt, ſo by the latter they were burſt, thrown into dropſies, and rendered incapable of travel. Frequently they met with no water for the whole day together: ſometimes they were diſappointed of it at night; in which caſe, if they were able they marched on; ſo that it was common with them to travel 30, 40, 50, or even 60 miles without encamping. Numbers through theſe hardſhips were obliged to lag in the rear; and of theſe many were left behind, and periſhed; for indeed ſcarce any ever joined the army again. Their miſeries, however, they ſuſtained with incredible patience, being encouraged by the example of their king; who, on this occaſion, ſuffered greater hardſhips than the meaneſt ſoldier in his army.

108 He arrives in Caramania.

At laſt they arrived at the capital of Gedroſia, where they refreſhed themſelves, and ſtaid ſome time: after which, they marched into Caramania; which being a very plentiful country, they there made themſelves ample amends for the hardſhips and fatigues they had ſuſtained. Here they were joined firſt by Craterus with the troops under his command, and a number of elephants; then came Staſanor preſident of the Arians, and Phariſmanes the ſon of Phrataphernes governor of Parthia. They brought with them camels, horſes and other beaſts of burden, in vaſt numbers; having foreſeen, that the king's march thro' Gedroſia would be attended with the loſs of the greateſt part, if not of all the cavalry and beaſts belonging to his army.

109 Redreſſes the grievances of his people.

During Alexander's ſtay in Caramania, he redreſſed the injuries of his people, who had been grievouſly oppreſſed by their governors during his abſence. Here alſo he was joined by his admiral Nearchus, who brought him an account that all under his command were in perfect ſafety, and in excellent condition; with which the king was mightily pleaſed, and, after having beſtowed on him ſingular marks of his favour, ſent him back to the navy. Alexander next ſet out for Perſia, where great diſorders had been committed during his abſence. Theſe alſo he redreſſed, and cauſed the governor to be crucified; appointing in his room Peuceſtas, who ſaved his life when he fought ſingly againſt a whole garriſon as above related. The new governor was no ſooner inveſted with his dignity, than he laid aſide the Macedonian garb, and put on that of the Medes; being the only one of Alexander's captains, who, by complying with the manners of the people he governed, gained their affection.

While Alexander viſited the different parts of Perſia, he took a view, among the reſt, of the ruins of Perſepolis, where he is ſaid to have expreſſed great ſorrow for the deſtruction he had formerly occaſioned. From Perſepolis he marched to Suſa, where he gave an an extraordinary looſe to pleaſure; reſolving to make himſelf and his followers ſome amends for the difficulties they had hitherto undergone; purpoſing at the ſame time ſo effectually to unite his new conquered with his hereditary ſubjects, that the jealouſies and fears, which had hitherto tormented both, ſhould no longer ſubſiſt. 110 Marries other two wives, Whith this view he married two wives of the blood royal of Perſia; viz. Barſine, or Statira, the daughter of Darius, and Paryſatis the daughter of Ochus. Drypetis, another daughter of Darius, he gave to Hephæſtion; Amaſtrine, the daughter of Oxyartes the brother of Darius, married Craterus; and to the reſt of his friends, to the number of 80, he gave other women of the greateſt quality. All theſe marriages were celebrated at once, Alexander himſelf beſtowing fortunes upon them; he directed likewiſe to take account of the number of his officers and ſoldiers who had married Aſiatic wives; and though they appeared to be 10,000, yet he gratified each of them according to his rank. 111 Pays the debts of his army. He next reſolved to pay the debts of his army, and thereupon iſſued an edict directing every man to regiſter his name and the ſum he owed; with which the ſoldiers complying ſlowly, from an apprehenſion that there was ſome deſign againſt them, Alexander ordered tables heaped with money to be ſet in all quarters of the camp, and cauſed every man's debts to be paid on his bare word, without even making any entry of his name; though the whole ſum came to 20,000 talents. On ſuch as had diſtinguiſhed themſelves in an extraordinary manner, he beſtowed crowns of gold. Peuceſtas had the firſt; Leonatus the ſecond; Nearchus the third; Oneſicritus the fourth; Hephæſtion the fifth; and the reſt of his guards had each of them one. After this he made other diſpoſitions for conciliating, as he ſuppoſed, the differences among all his ſubjects. He reviewed the 30,000 youths, whom at his departure for India he had ordered to be taught Greek and the Macedonian diſcipline; expreſſing high ſatisfaction at the fine appearance they made, which rendered them worthy of the appellation he beſtowed on them, viz that of *Epigoni*, i. e. ſucceſſors. He promoted alſo, without any diſtinction of nation, all thoſe who had ſerved him faithfully and valiantly in the Indian war. When all theſe regulations were made, he gave the command of his heavy armed troops to Hephæſtion, and ordered him to march directly to the banks of the Tigris, while in the mean time a fleet was equipped for carrying the king and the troops he retained with him down to the ocean.

Thus ended the exploits of Alexander; the greateſt conqueror that ever the world ſaw, at leaſt with reſpect to the rapidity of his conqueſts. In 12 years time he had brought under his ſubjection Egypt, Libya, Aſia Minor, Syria, Phœnicia, Paleſtine, Babylonia, Perſia, with part of India and Tartary. Still, however, he meditated greater things. He had now got a great taſte in maritime affairs; and is ſaid to have meditated a voyage to the coaſts of Arabia and Ethiopia, and thence round the whole continent of Africa to the ſtraits of Gibraltar. But of this there is no great certainty; though that he intented to ſubdue the Carthaginians and Italians, is more than probable. All theſe deſigns, however, were fruſtrated by his death, which happened at Babylon in 323 B. C. He is ſaid to have received ſeveral warnings of his approaching fate, and to have been adviſed to avoid that city; which advice he either deſpiſed or could not follow. 112 He dies at Babylon. He died of a fever after eight days illneſs, without naming any ſucceſſor; having only given his ring to Perdiccas, and left the kingdom, as he ſaid, *to the moſt worthy*.

113 His character. The character of this great prince has been variouſly repreſented; but moſt hiſtorians ſeem to have looked upon him rather as an illuſtrious madman than one upon whom the epithet of *Great* could be properly beſtowed. From a careful obſervation of his conduct, however, it muſt appear, that he poſſeſſed not only a capacity to plan, but likewiſe to execute, the greateſt enterpriſes that ever entered into the mind of any of the human race. From whatever cauſe the notion originated, it is plain that he imagined himſelf a divine perſon, and born to ſubdue the whole world: and extravagant and impracticable as this ſcheme may appear at preſent, it cannot at all be looked upon in the ſame light in the time of Alexander. The Greeks were in his time the moſt powerful people in the world in reſpect to their ſkill in the military art, and the Perſians were the moſt powerful with reſpect to wealth and numbers. The only other powerful people in the world were the Carthaginians, Gauls, and Italian nations. From a long ſeries of wars which the Carthaginians carried on in Sicily, it appeared that they were by no means capable of contending with the Greeks even when they had an immenſe ſuperiority of numbers; much leſs then could they have ſuſtained an attack from the whole power of Greece and Aſia united. The Gauls and Italians were indeed very brave, and of a martial diſpoſition; but they were barbarous and could not have reſiſted armies well diſciplined and under the command of ſuch a ſkilful leader as Alexander. Even long after his time, it appeared that the Romans themſelves could not have reſiſted the Greeks; ſince Regulus, after having defeated the Carthaginians and reduced them to the utmoſt diſtreſs, was totally unable to reſiſt a Carthaginian army commanded by a Greek general, and guided by Greek diſcipline.

Thus it appears, that the ſcheme of Alexander cannot by any means be accounted that of a madman, or of one who projects great things without judgment or means to execute them. If we conſider from his actions the end which moſt probably he had in view, could his ſcheme have been accompliſhed, we ſhall find it not only the greateſt but the *beſt* that can poſſibly be imagined. He did not conquer to deſtroy, enſlave, or oppreſs; but to civilize, and unite the whole world as one nation. No ſooner was a province conquered than he took care of it as if it had been part of his paternal inheritance. He allowed not his ſoldiers to oppreſs and plunder the Perſians, which they were very much inclined to do; on the contrary, by giving into the oriental cuſtoms himſelf, he ſtrove to extinguiſh that inveterate hatred which had ſo long ſubſiſted between the two nations. In the Scythian countries which he ſubdued, he purſued the ſame excellent plan. His courage and military ſkill, in which he never was excelled, were diſplayed, not with a view to rapine, or deſultory conqueſt, but to civilize and induce the barbarous inhabitants to employ themſelves in a more proper way of Life. "Amidſt the hardſhip's of a military life (ſays Dr Gillies), obſtinate ſieges, bloody battles, and dear bought victories, he ſtill reſpected the rights of mankind, and practiſed the mild virtues of humanity. The conquered nations enjoyed their ancient laws and privileges; the rigours of deſpotiſm ſoftened; arts and induſtry encouraged; and the proudeſt Macedonian governors compelled, by the authority and example of Alexander, to obſerve the rules of juſtice towards their meaneſt ſubjects. To bridle the fierce inhabitants of the Scythian plains, he founded cities and eſtabliſhed colonies on the banks of the Iaxartes and Oxus; and thoſe deſtructive campaigns uſually aſcribed to his reſtleſs activity and blind ambition, appeared to the diſcernment of this extraordinary man not only eſſential to the ſecurity of the conqueſts which he had already made, but neceſſary for the more remote and ſplendid expeditions which he ſtill purpoſed to undertake, and which he performed with ſingular boldneſs and unexampled ſucceſs."—In another place the ſame author gives his character in the following words.

"He was of a low ſtature, and ſomewhat deformed; but the activity and elevation of his mind animated and ennobled his fame. By a life of continual labour, and by an early and habitual practice of the gymnaſtic exerciſes, he hardened his body againſt the impreſſions of cold and heat, hunger and thirſt, and prepared his robuſt conſtitution for bearing ſuch exertions of ſtrength and activity, as have appeared incredible to the undiſciplined ſoftneſs of modern times. In generoſity and in proweſs, he rivalled the greateſt heroes of antiquity; and in the race of glory, having finally outſtripped all competitors, became ambitious to ſurpaſs himſelf. His ſuperior ſkill in war gave uninterrupted ſucceſs to his arms; and his natural humanity, enlightened by the philoſophy of Greece, taught him to improve his conqueſts to the beſt intereſts of mankind. In his extenſive dominions, he built or founded not leſs than 70 cities; the ſituation of which being choſen with conſummate wiſdom, tended to facilitate communication, to promote commerce, and to diffuſe civility through the greateſt nations of the earth. It may be ſuſpected, indeed, that he miſtook the extent of human power, when in the courſe of one reign he undertook to change the face of the world; and that he miſcalculated the ſtubbornneſs of ignorance and the force of habit, when he attempted to enlighten barbariſm to ſoften ſervitude, and to tranſplant the improvements of Greece into an African and Aſiatic ſoil, where they have never been known to flouriſh. Yet let not the deſigns of Alexander be too haſtily accuſed of extravagance. Whoever ſeriouſly conſiders what he actually performed before his 33d year, will be cautious of determining what he might have accompliſhed had he reached the ordinary term of human life. His reſources were peculiar to himſelf; and ſuch views as well as actions became him as would have become none beſides. In the language of a philoſophical hiſtorian, 'he ſeems to have been given to the world by a peculiar diſpenſation of Providence, being a man like to none other of the human kind.'

"From the part which his father Philip and himſelf acted in the affairs of Greece, his hiſtory has been tranſmitted through the impure channels of exaggerated flattery or malignant envy. The innumerable fictions, which diſgrace the works of his biographers, are contradicted by the moſt authentic accounts of his reign, and inconſiſtent with thoſe public tranſactions which concurring authorities confirm. In the preſent work it ſeemed unneceſſary to expatiate on ſuch topics, ſince it is leſs the buſineſs of hiſtory to repeat or even to expoſe errors than to ſelect and impreſs uſeful truths. An author, ambitious of attaining that purpoſe, can ſeldom indulge the language of general panegyric. He will acknowledge, that Alexander's actions were not always blameleſs; but, after the moſt careful examination, he will affirm, that his faults were few in number, and reſulted from his ſituation rather than from his character.

"From the firſt years of his reign he experienced the crimes of diſaffection and treachery, which multiplied and became more dangerous with the extent of his dominions and the difficulty to govern them. Several of his lieutenants early aſpired at independence; others formed conſpiracies againſt the life of their maſter. The firſt criminals were treated with a lenity becoming the generous ſpirit of Alexander: But when Philotas, the ſon of Parmenio, and even Parmenio himſelf, afforded reaſon to ſuſpect their fidelity; when the Macedonian youths, who, according to the inſtitution of Philip, guarded the royal pavilion, prepared to murder their ſovereign, he found it neceſſary to depart from his lenient ſyſtem, and to hold with a firmer hand the reins of government. Elated by unexampled proſperity, and the ſubmiſſive reverence of vanquiſhed nations, his loftineſs diſguſted the pride of his European troops, particularly the Macedonian nobles, who had been accuſtomed to regard themſelves rather as his companions than ſubjects. The pretenſions which ſound policy taught him to form and to maintain, of being treated with thoſe external honours ever claimed by the monarchs of the Eaſt, highly offended the religious prejudices of the Greeks, who deemed it impious to proſtrate the body or bend the knee to any mortal ſovereign. Yet had he remitted formalities conſecrated by the practice of ages, he muſt inſenſibly have loſt the reſpect of his Aſiatic ſubjects. With a view to reconcile the diſcordant principles of the victors and vanquiſhed, he affected an immediate deſcent from Jupiter Ammon, a claim liberally admitted by the avarice or fears of the Lybian prieſts; and which he had reaſon to expect, could not be very obſtinately denied by the credulity of the Greeks and Macedonians, who univerſally acknowledged that Philip, his reputed father, was remotely deſcended from the Grecian Jupiter. But the ſucceſs of this deſign, which might have intitled him, as ſon of Jupiter, to the ſame obeiſance from the Greeks which the barbarians readily paid him as monarch of the Eaſt, was counteracted, at firſt by the ſecret diſpleaſure, and afterwards by the open indignation, of ſeveral of his generals and courtiers. Nor did the conduct of Alexander tend to extricate him from this difficulty. With his friends he maintained that equal intercourſe of viſits and entertainments which characteriſed the Macedonian manners; indulged the liberal flow of unguarded converſation; and often exceeded that intemperance in wine which diſgraced his age and country.

We ſhall conclude this character of Alexander with obſerving, that he had in view, and undoubtedly muſt have accompliſhed, the ſovereignty of the ocean as well as of the land. The violent reſiſtance made by the Tyrians had ſhown him the ſtrength of a commercial nation; and it was undoubtedly with a view to enrich his dominions by commerce, that he equipped the fleet on the Indus, and wiſhed to keep up a communication with India by land as well as by ſea. "It was chiefly with a view to the latter of theſe objects (ſays Dr Robertſon), that he examined the navigation of the Indus with ſo much attention. With the ſame view, on his return to Suſa, he in perſon ſurveyed the courſe of the Euphrates and Tigris, and gave directions to remove the cataracts or dams with which the ancient monarchs of Perſia, induced by a peculiar precept of their religion, which enjoined them to guard with the utmoſt care againſt defiling any of the elements, had conſtructed near the mouths of theſe rivers, in order to ſhut out their ſubjects from any acceſs to the ocean. By opening the navigation in this manner, he propoſed, that the valuable commodities of India ſhould be conveyed from the Perſian Gulph into the interior parts of his Aſiatic dominions, while by the Arabian Gulph they ſhould be carried to Alexandria, and diſtributed to the reſt of the world.

"Grand and extenſive as theſe ſchemes were, the precautions employed, and the arrangements made for carrying them into execution, were ſo various and ſo proper, that Alexander had good reaſon to entertain ſanguine hopes of their proving ſucceſsful. At the time when the mutinous ſpirit of his ſoldiers obliged him to relinquiſh his operations in India, he was not 30 years of age complete. At this enterpriſing period of life, a prince of a ſpirit ſo active, perſevering, and indefatigable, muſt have ſoon found means to reſume a favourite meaſure on which he had been long intent. If he had invaded India a ſecond time, he would not, as formerly, have been obliged to force his way through hoſtile and unexplored regions, oppoſed at every ſtep by nations and tribes of barbarians whoſe names had never reached Greece. All Aſia, from the ſhores of the Ionian ſea to the banks of the Hyphaſis, would then have been ſubject to his dominion; and through that immenſe ſtretch of country he had eſtabliſhed ſuch a chain of cities or fortified ſtations, that his armies might have continued their march with ſafety, and have found a regular ſucceſſion of magazines provided for their ſubſiſtence. Nor would it have been difficult for him to bring into the field forces ſufficient to have atchieved the conqueſt of a country ſo populous and extenſive as India. Having armed and diſciplined his ſubjects in the Eaſt like Europeans, they would have been ambitious to imitate and to equal their inſtructors; and Alexander might have drawn recruits, not from his ſcanty domains in Macedonia and Greece, but from the vaſt regions of Aſia, which in every age has covered the earth, and aſtoniſhed mankind with its numerous armies. When at the head of ſuch a formidable power he had reached the confines of India, he might have entered it under circumſtances very different from thoſe in his firſt expedition. He had ſecured a firm footing there, partly by means of the garriſons which he left in the three cities which he had built and fortified, and partly by his alliance with Taxiles and Porus. Theſe two Indian Princes, won by Alexander's humanity and beneficence, which, as they were virtues ſeldom diſplayed in the ancient mode of carrying on war, excited of courſe an higher degree of admiration and gratitude, had continued ſteady in their attachment to the Macedonians. Reinforced by their troops, and guided by their information as well as by the experience which he had acquired in his former campaigns, Alexander muſt have made a rapid progreſs in a country where every invader from his time to the preſent age has proved ſucceſsful.

"But this and all his other ſplendid ſchemes were terminated at once by his untimely death. In conſequence of that, however, events took place which illuſtrate and confirm the juſtneſs of the preceding ſpeculations and conjectures by evidence the moſt ſtriking and ſatisfactory. When that great empire, which the ſuperior genius of Alexander had kept united and in ſubjection, no longer felt his ſuperintending control, it broke into pieces, and its various provinces were ſeized by his principal officers, and parcelled out among them. From ambition, emulation, and perſonal animoſity, they ſoon turned their arms againſt one another; and as ſeveral of the leaders were equally eminent for political abilities and for military ſkill, the conteſt was maintained long, and carried on with frequent viciſſitudes of fortune. Amidſt the various convulſions and revolutions which theſe occaſioned, it was found that the meaſures of Alexander for the preſervation of his conqueſts had been concerted with ſuch ſagacity, that upon the final reſtoration of tranquillity, the Macedonian dominion continued to be eſtabliſhed in every part of Aſia, and not one province had ſhaken off the yoke. Even India, the moſt remote of Alexander's conqueſts, quietly ſubmitted to Pytho the ſon of Agenor, and afterwards to Seleucas, who ſucceſſively obtained dominion over that part of Aſia. Porus and Taxiles, notwithſtanding the death of their benefactor, neither declined ſubmiſſion to the authority of the Macedonians nor made any attempt to recover independence."

114 Causes of the diſſolution of his empire.

With the death of Alexander fell alſo the glory of the Macedonians; who very ſoon relapſed into a ſituation as bad, or worſe, than that in which they had been before the reign of Philip. This was occaſioned principally by his not having diſtinctly named a ſucceſſor, and having no child of his own come to the years of diſcretion to whom the kingdom might ſeem naturally to belong. The ambition and jealouſy of his mother Olympias, his queen Roxana, and eſpecially of the great commanders of his army, not only prevented a ſucceſſor from being ever named, but occaſioned the death of every perſon, whether male or female, who was in the leaſt related to Alexander. To have a juſt notion of the origin of theſe diſturbances, it is neceſſary in the firſt place to underſtand the ſituation of the Macedonian affairs at the time of Alexander's death.

When Alexander ſet out for Aſia, he left Antipater, as we formerly obſerved, in Macedon, to prevent any diſturbances that might ariſe either there or in Greece. The Greeks, even during the lifetime of Alexander, bore the ſuperiority which he exerciſed over them with great impatience; and, though nothing could be more gentle than the government of Antipater, yet he was exceedingly hated, becauſe he obliged them to be quiet. One of the laſt actions of Alexander's life ſet all Greece in a flame. He had, by an edict, directed all the cities of Greece to recal their exiles; which edict, when it was publiſhed at the Olympic games, created much confuſion. Many of the cities were afraid, that, when the exiles returned, they would change the government; moſt of them doubted their own ſafety if the edict took place; and all of them held this peremptory decree to be a total abolition of their liberty. No ſooner therefore did the news of Alexander's death arrive than they prepared for war.

115
Aridæus appointed king.

116
A party formed by Meleager, and another by Perdiccas.

In Aſia the ſtate of things was not much better; not indeed through any inclination of the conquered countries to revolt, but through the diſſenſions among the commanders.—In the general council which was called ſoon after the death of Alexander, after much confuſion and altercation, it was at laſt agreed, or rather commanded by the ſoldiers, that Aridæus the brother of Alexander, who had always accompanied the king, and had been wont to ſacrifice with him, ſhould aſſume the ſovereignty.—This Aridæus was a man of very ſlender parts and judgment, not naturally but by the wicked practices of Olympias, who had given him poiſonous draughts in his infancy, leſt he ſhould ſtand in the way of her ſon Alexander or any of his family; and for this, or ſome other reaſon, Perdiccas, Ptolemy, and moſt of the horſe-officers, reſented his promotion to ſuch a degree, that they quitted the aſſembly, and even the city. However, Meleager, at the head of the phalanx, vigorouſly ſupported their firſt reſolution, and threatened loudly to ſhed the blood of thoſe who affected to rule over their equals, and to aſſume a kingdom which no way belonged to them, Aridæus was accordingly arrayed in royal robes, had the arms of Alexander put upon him, and was ſaluted by the name of *Philip*, to render him more popular. Thus were two parties formed at the head of whom were Meleager and Perdiccas; both of them pretending vaſt concern for the public good, yet, at bottom, deſiring nothing more than their own advantage. Perdiccas was a man of high birth, had had a ſupreme command in the army, was much in favour with Alexander, and one in whom the nobility had put great confidence. Meleager was become formidable by having the phalanx on his ſide, and having the nominal king entirely in his power: for Aridæus, or Philip, was obliged to comply with whatever he thought proper and publickly declared, that whatever he did was by the advice of Meleager; ſo that he made his miniſter unacountable for his own ſchemes, and no way endangered himſelf. The Macedonians alſo, beſides, their regard for the deceaſed king, ſoon began to entertain a perſonal love for Philip on account of his moderation.

117
Meleager murdered and the empire divided.

It is remarkable, however, that notwithſtanding all the favours which Alexander had conferred upon his officers, and the fidelity with which they had ſerved him during his life, only two of them were attached to the intereſts of his family after his death. Theſe were Antipater and Eumenes the Cardian, whom he had appointed his ſecretary. Antipater, as we have already ſeen, was embroiled with the Greeks, and could not aſſiſt the royal family who were in Aſia; and Eumenes had not as yet ſufficient intereſt to form a party in their favour. In a ſhort time, however, Perdiccas prevailed againſt Meleager, and got him murdered; by which means the ſupreme power for a time fell into his hands. His firſt ſtep, in conſequence of this power, was to diſtribute the provinces of the empire among the commanders in the following manner, in order to prevent competitors, and to ſatisfy the ambition of the principal commanders of the army. Aridæus, and the ſon of Roxana, born after the death of his father, were to enjoy the regal authority. Antipater had the government of the European provinces. Craterus had the title of *protector*. Perdiccas was general of the houſehold troops in the room of Hephæſtion. Ptolemy the ſon of Lagus had Egypt, Libya, and that part of Arabia which borders upon Egypt. Cleomenes, a man of infamous character, whom Alexander had made receiver-general in Egypt, was made Ptolemy's deputy. Leomedon had Syria; Philotas, Cilicia; Pithon, Media; Eumenes, Cappadocia, Paphlagonia, and all the country bordering on the Euxine Sea, as far as Trapezus; but theſe were not yet conquered, ſo that he was a governor without a province. Antigonus had Pamphylia, Lycia, and Phrygia Major; Caſſander, Caria; Menander; Lydia; Leonatus, Phrygia on the Helleſpont.

118
Alexander's body neglected, and his will ſet aſide.

In the mean time, not only Alexander's will, but Alexander himſelf, was ſo much neglected, that his body was allowed to remain ſeven days before any notice was taken of it, or any orders given for its being embalmed. The only will he left was a ſhort memorandum of ſix things he would have done.—1. The building of a fleet of 1000 ſtout galleys, to be made uſe of againſt the Carthaginians and other nations who ſhould oppoſe the reduction of the ſea-coaſts of Africa and Spain, with all the adjacent iſlands as far as Sicily. 2. A large and regular highway was to be made along the coaſt of Africa, as far as Ceuta and Tangier. 3. Six temples of extraordinary magnificence were to be erected at the expence of 1500 talents each. 4. Caſtles, arſenals, havens, and yards for building ſhips, to be ſettled in proper places throughout his empire. 5. Several new cities were to be built in Europe and Aſia; thoſe in Aſia to be inhabited by colonies from Europe, and thoſe in Europe to be filled with Aſiatics; that, by blending their people and their manners, that hereditary antipathy might be eradicated which had hitherto ſubſiſted between the inhabitants of the different continents. 6. Laſtly, he had projected the building of a pyramid, equal in bulk and beauty to the biggeſt in Egypt in honour of his father Philip. All theſe deſigns, under pretence of their being expenſive, were referred to a council of Macedonians, to be held nobody knew when or where.

119
The daughters of Darius put to death by Roxana.

The government, being now in the hands of Perdiccas and Roxana, grew quickly very cruel and diſtaſteful. Alexander was ſcarce dead when the queen ſent for Statira and Drypetis, the two daughters of Darius, one of whom had been married to Alexander and the other to Hephæſtion; but as ſoon as they arrived at Babylon, cauſed them both to be murdered, that no ſon of Alexander by any other woman, or of Hephæſtion, might give any trouble to her or her ſon Alexander.

Alexander. Syſigambis, the mother of Darius, no ſooner heard that Alexander the Great was dead, than ſhe laid violent hands on herſelf, being apprehenſive of the calamities which were about to enſue.

120 The Greeks revolt, but are ſubdued.

War was firſt declared in Greece againſt Antipater in the year 321 B. C. Through the treachery of the Theſſalians, that general was defeated, with the army he had under his own command. Leonatus was therefore ſent from Aſia, with a very conſiderable army, to his aſſiſtance; but both were overthrown with great loſs by the confederates, and Leonatus himſelf was killed. In a ſhort time, however, Craterus arrived in Greece with a great army, the command of which he reſigned to Antipater. The army of the confederates amounted to 25,000 foot and 3000 horſe; but Antipater commanded no fewer than 40,000 foot, 3000 archers, and 5000 horſe. In ſuch an unequal conteſt, therefore, the Greeks were defeated, and forced to ſue for peace; which they did not obtain but on condition of their receiving Macedonian garriſons into ſeveral of their cities. At Athens alſo the democratic government was abrogated; and ſuch a dreadful puniſhment did this ſeem to the Athenians, that 22,000 of them left their country, and retired into Macedon.

121 Diſturbances in Aſia and Thrace.

While theſe things were doing in Greece, diſturbances began alſo to ariſe in Aſia and in Thrace. The Greek mercenaries, who were diſperſed through the inland provinces of Aſia, deſpairing of ever being allowed to return home by fair means, determined to attempt it by force. For this purpoſe, they aſſembled to the number of 20,000 foot and 3000 horſe; but were all cut off to a man by the Macedonians. In Thrace, Lyſimachus was attacked by one Seuthes, a prince of that country who claimed the dominions of his anceſtors, and had raiſed an army of 20,000 foot and 8000 horſe. But though the Macedonian commander was forced to engage this army with no more than 4000 foot and 2000 horſe, yet he kept the field of battle, and could not be driven out of the country.

122 Ambition and cruelty of Perdiccas.

Perdiccas, in the mean time, by pretending friendſhip to the royal family, had gained over Eumenes entirely to his intereſt; and at laſt put him in poſſeſſion of the province of Cappadocia by the defeat of Ariarathes king of that country, whom he afterwards cruelly cauſed to be crucified. His ambition, however, now began to lead him into difficulties. At the firſt diviſion of the provinces, Perdiccas, to ſtrengthen his own authority, had propoſed to marry Nicæa the daughter of Antipater; and ſo well was this propoſal reliſhed, that her brethren Jollas and Archias conducted her to him, in order to be preſent at the celebration of the nuptials. But Perdiccas now had other things in view. He had been ſolicited By Olympias to marry her daughter Cleopatra, the widow of Alexander king of Epirus, and who then reſided at Sardis in Lydia. Eumenes promoted this match to the utmoſt of his power, becauſe he thought it would be for the intereſt of the royal family; and his perſuaſions had ſuch an effect on Perdiccas, that he was ſent to Sardis to compliment Cleopatra, and to carry peſents to her in name of her new lover. In the abſence of Eumenes, however, Alcetas, the brother of Perdiccas, perſuaded him to marry Nicæa; but, in order to gratify his ambition, he reſolved to divorce her immediately after mariage, and marry Cleopatra. By this laſt marriage, he hoped to have pretence for altering the government of Macedon; and, as a neceſſary meaſure preparative to theſe, he entered into contrivances for deſtroying Antigonus. Unfortunately for himſelf, however, he ruined all his ſchemes by his own jealouſy and precipitate cruelty. Cynane, the daughter of Philip by his ſecond wife, had brought her daughter named *Adda*, and who was afterwards named *Eurydice*, to court, in hopes that king Aridæus might marry her. Againſt Cynane, Perdiccas, on ſome political motives, conceived ſuch a grudge, that he cauſed her to be murdered. This raiſed a commotion in the army; which frightened Perdiccas to ſuch a degree that he now promoted the match between Aridæus and Eurydice; to prevent which, he had murdered the mother of the young princeſs. But, in the mean time, Antigonus, knowing the deſigns of Perdiccas againſt himſelf, fled with his ſon Demetrius to Greece there to take ſhelter under the protection of Antipater and Craterus, whom he informed of the ambition and cruelty of the regent.

123 A combination againſt him.

A civil war was now kindled. Antipater, Craterus Neoptolemus, and Antigonus, were combined againſt Perdiccas; and it was the misfortune of the empire in general, that Eumenes, the moſt able general, as well as the moſt virtuous of all the commanders, was on the ſide of Perdiccas, becauſe he believed him to be in the intereſt of Alexander's family. Ptolemy, in the mean time, remained in quiet poſſeſſion of Egypt; but without the leaſt intention of owning any perſon for his ſuperior: however, he alſo acceded to the league formed againſt Perdiccas; and thus the only perſon in the whole empire who conſulted the intereſt of the royal family was Eumenes.

124 Alexander buried in Egypt.

It was now thought proper to bury the body of Alexander, which had been kept for two years, during all which time preparations had been making for it. Aridæus, to whoſe care it was committed, ſet out from Babylon for Damaſcus, in order to carry the king's body to Egypt. This was ſore againſt the will of Perdiccas; for it ſeems there was a ſuperſtitious report, that wherever the body of Alexander was laid, that country ſhould flouriſh moſt. Perdiccas, therefore, out of regard to his native ſoil, would have it conveyed to the royal ſepulchres in Macedon; but Aridæus, pleading the late king's expreſs direction, was determined to carry it into Egypt, from thence to be conveyed to the temple of Jupiter Ammon. —The funeral was accordingly conducted with all imaginable magnificence. Ptolemy came to meet the body as far as Syria: but, inſtead of burying it in the temple of Jupiter Ammon, erected a ſtately temple for it in the city of Alexandria; and, by the reſpect he ſhowed for his dead maſter, induced many of the Macedonian veterans to join him, and who were afterwards of the greateſt ſervice to him.

125 Perdiccas killed by his own men.

No ſooner was the funeral over, than both the parties abovementioned fell to blows. Perdiccas marched againſt Ptolemy; but was ſlain by his own men, who, after the death of their general, ſubmitted to his antagoniſt; and thus Eumenes was left alone to contend againſt all the other generals who had ſerved under Alexander. In this conteſt, however, he would by no means have been overmatched, had his ſoldiers been attached to him; but as they had been accuſtomed to ſerve under thoſe very generals againſt whom they were now to fight, they were on all occaſions ready to betray and deſert Eumenes. However, he defeated and killed Neoptolemus and Craterus, but then found himſelf obliged to contend with Antipater and Antigonus. Antipater was now appointed protector of the kings, with ſovereign power; and Eumenes was declared a public enemy. A new diviſion of Alexander's empire took place. Egypt, Libya, and the parts adjacent, were given to Ptolemy becauſe they could not be taken from him. Syria was confirmed to Leomedon. Philoxenus had Cilicia. Meſopotamia and Arbelitis were given to Amphimachus. Babylon was beſtowed on Seleucus. Suſiana fell to Antigenes, who commanded the Macedonian *Argyraſpidæ* or *Silver Shields*, becauſe he was the firſt who oppoſed Perdiccas. Peuceſtas held Perſia. Tlepolemus had Caramania. Pithon had Media as far as the Caſpian ſtraits. Stafander had Aria and Drangia. Philip, Parthia. Staſonor, Bactria and Sogdia. Sybirtius, Aracopa. Oxyartes, the father of Roxana, Parapomiſis. Another Pithon had the country between this province and India. Porus and Taxiles held what Alexander had given them, becauſe they would not part with any of their dominions. Cappadocia was aſſigned to Nicanor, Phrygia Major, Lycaonia, Pamphylia, and Lycia, were given to Antigonus. Caria to Caſſander, Lydia to Clytus, Phrygia the Leſs to Aridæus. Caſſander was appointed general of the horſe; while the command of the houſehold troops was given to Antigonus, with orders to proſecute the war againſt Eumenes.—Antipater having thus ſettled every thing as well as he could, returned to Macedon with the two kings, to the great joy of his countrymen, having left his ſon Caſſander to be a check upon Antigonus in Aſia.

126
A new diviſion of the empire.

Matters now ſeemed to wear a better aſpect than they had yet done; and, had Eumenes believed that his enemies really conſulted the intereſt of Alexander's family, there is not the leaſt doubt that the war would have been immediately terminated. He ſaw, however, that the deſign of Antigonus was only to ſet up for himſelf, and therefore he refuſed to ſubmit. From this time, therefore, the Macedonian empire ceaſed in Aſia; and an account of the tranſactions of this part of the world fall to be recorded under the article SYRIA. The Macedonian affairs are now entirely confined to the kingdom of Macedon itſelf, and to Greece.

127
Total deſtruction of Alexander's family.

Antipater had not long been returned to Macedon, when he died; and the laſt action of his life completed the ruin of Alexander's family. Out of a view to the public good, he had appointed Polyſperchon, the eldeſt of Alexander's captain's at hand, to be *protector* and *governor* of Macedon. This failed not to diſguſt his ſon Caſſander; who thought he had a natural right to theſe offices, and of courſe kindled a civil war in Macedon. This was indeed highly promoted by his firſt actions as a governor . He began with attempting to remove all the governors appointed in Greece by Antipater, and to reſtore democracy wherever it had been aboliſhed. The immediate conſequence of this was, that the people refuſed to obey their magiſtrates; the governors refuſed to reſign their places, and applied for aſſiſtance to Caſſander. Polyſperchon alſo had the imprudence to recal Olympias from Epirus, and allow her a ſhare in the adminiſtration; which Antipater, and even Alexander himſelf, had always refuſed her. The conſequence of all this was, that Caſſander invaded Greece, where he prevailed againſt Polyſperchon: Olympias returned to Macedon, where ſhe cruelly murdered Aridæus and his wife Eurydice; ſhe herſelf was put to death by Caſſander, who afterwards cauſed Roxana and her ſon to be murdered, and Polyſperchon being driven into Etolia, firſt raiſed to the crown Hercules the ſon of Alexander by the daughter of Darius, and then by the inſtigation of Caſſander murdered him, by which means the line of Alexander the Great became totally extinct.

128
Various revolutions in the government

Caſſander having thus deſtroyed all the royal family, aſſumed the regal title, as he had for 16 years before had all the power. He enjoyed the title of *king of Macedon* only three years; after which he died, about 298 B. C. By Theſſalonica, the daughter of Philip king of Macedon he left three ſons, Philip, Antipater, and Alexander. Philip ſucceeded him, but ſoon after died of a conſumption. A conteſt immediately began between the two brothers, Antipater and Alexander. Antipater ſeized the kingdom; and to ſecure himſelf in it, murdered his mother Theſſalonica, if not with his own hand, at leaſt the execrable fact was committed in his preſence. Alexander invited Pyrrhus king of Epirus, and Demetrius the ſon of Antigonus, to aſſiſt him and revenge the death of his mother. But Pyrrhus being bought off, and a peace concluded between the brothers, Alexander, being afraid of having too many protectors, formed a ſcheme of getting Demetrius aſſaſſinated. Inſtead of this, however, both he and Antipater were put to death; and Demetrius became king of Macedon four years after the death of Caſſander.

In 287 B. C. Demetrius was driven out by Pyrrhus, who was again driven out by Lyſimachus two years after, who was ſoon after killed by Seleucus Nicator; and Seleucus, in his turn, was murdered by Ptolemy Ceranus, who became king of Macedon about 280 B. C. The new king was in a ſhort time cut off, with his whole army, by the Gauls; and Antigonus Gonatus, the ſon of Demetrius Poliorcetes, became king of Macedon in 278 B. C. He proved ſucceſsful againſt the Gauls, but was driven out by Pyrrhus king of Epirus; who, however, ſoon diſobliged his ſubjects to ſuch a degree, that Antigonus recovered a great part of his kingdom. But in a little time, Pyrrhus being killed at the ſiege of Argos in Greece, Antigonus was reſtored to the whole of Macedon; but ſcarcely was he ſeated on the throne, when he was driven from it by Alexander the ſon of Pyrrhus. This new invader was, in his turn, expelled by Demetrius the ſon of Antigonus; who, though at that time but a boy, had almoſt made himſelf maſter of Epirus. In this enterpriſe, however, he was diſappointed; but by his means Antigonus was reſtored to his kingdom, which he governed for many years in peace. By a ſtratagem he made himſelf maſter of the city of Corinth, and from that time began to form ſchemes for the thorough conqueſt of Greece. The method he took to accompliſh this was, to ſupport the petty tyrants of Greece againſt the free ſtates: which indeed weakened the power of the

the latter; but involved the whole country in ſo many calamities, that theſe tranſactions could not redound much to the reputation either of his arms or his honour. About 243 B. C. he died, leaving the kingdom to his ſon, Demetrius II.

129 War with the Romans.

Neither Demetrius, nor his ſucceſſor Antigonus Doſon, performed any thing remarkable. In 221 B. C. the kingdom fell to Philip, the laſt but one of the Macedonian monarchs. To him Hannibal applied for aſſiſtance after the battle of Cannæ, which he refuſed, and the ſame imprudence which made him refuſe this aſſiſtance prompted him to embroil himſelf with the Romans; and at laſt to conclude a treaty with them, by which he in effect became their ſubject, being tied up from making peace or war but according to their pleaſure. In 179 B. C. he was ſucceeded by his eldeſt ſon Perſes, under whom the war with the Romans was renewed. Even yet the Macedonians were terrible in war; and their phalanx when properly conducted, ſeems to have been abſolutely invincible by any method of making war known at that time. It conſiſted of 16,000 men, of whom 1000 marched abreaſt, and thus was 16 men deep, each of whom carried a kind of pike 23 feet long. The ſoldiers ſtood ſo cloſe, that the pikes of the fifth rank reached their points beyond the front of the battle. The hindermoſt ranks leaned their pikes on the ſhoulders of thoſe who went before them, and, locking them faſt, preſſed briſkly againſt them when they made the charge; ſo that the firſt five ranks had the impetus of the whole phalanx, which was the reaſon why the ſhock was generally irreſiſtible. The Romans had never encountered ſuch a terrible enemy; and in the firſt battle, which happened 171 B. C. they were defeated with the loſs of 2200 men, while the Macedonians loſt no more than 60. The generals of Perſes now preſſed him to ſtorm the enemy's camp; but he being naturally of a cowardly diſpoſition refuſed to comply, and thus the beſt opportunity he ever had was loſt. Still, however, the Romans gained little or no advantage, till the year 168 B.C. when Paulus Æmilius, a moſt experienced commander, was ſent into Macedon. Perſes now put all upon the iſſue of a general engagement; and Æmilius, with all his courage and military experience, would have been defeated, had the Macedonians been commanded by a general of the ſmalleſt courage or conduct. The light armed Macedonians charged with ſuch vigour, that after the battle ſome of their bodies were found within two furlongs of the Roman camp. When the phalanx came to charge, the points of their ſpears ſtriking into the Romans ſhields, kept the heavy armed troops from making any motion; while, on the other hand Perſes's light-armed men did terrible execution. On this occaſion it is ſaid that Æmilius tore his clothes, and gave up all hopes. However, perceiving that as the phalanx gained ground it loſt its order in ſeveral places, he cauſed his own light-armed troops to charge in thoſe places, whereby the Macedonians were ſoon put into confuſion. If Perſes with his horſe had on the firſt appearance of this charged the Romans briſkly, his infantry would have been able to recover themſelves; but inſtead of this, he betook himſelf to flight, and the infantry at laſt did the ſame, but not till 20,000 of them had loſt their lives.

This battle decided the fate of Macedonia, which immediately ſubmitted to the conqueror. The cowardly king took refuge in the iſland of Samothrace; but was at laſt obliged to ſurrender to the Roman conſul, by whom he was carried to Rome, led in triumph, and afterwards moſt barbarouſly uſed. Some pretenders to the throne appeared afterwards; but being unable to defend themſelves againſt the Romans, the country was reduced to a Roman province in 148 B. C. To them it continued ſubject till the year 1357, when it was reduced by the Turkiſh ſultan Bajazet, and hath remained in the hands of the Turks ever ſince.

130 Macedonia becomes a Roman province.

MACEDONIANS, in eccleſiaſtical hiſtory, the followers of Macedonius, biſhop of Conſtantinople, who, through the influence of the Eunomians, was depoſed by the council of Conſtantinople in 360, and ſent into exile. He conſidered the Holy Ghoſt as a divine energy diffuſed throughout the univerſe, and not as a perſon diſtinct from the Father and the Son. The ſect of Macedonians was cruſhed before it had arrived at its full maturity, by the council aſſembled by Theodoſius in 381, at Conſtantinople. See SEMIARIANS.

MACEDONIUS. See MACEDONIANS.

MACER (EMILIUS), an ancient Latin poet, was born at Verona, and flouriſhed under Auguſtus Cæſar. Euſebius relates, that he died a few years after Virgil. Ovid ſpeaks of a poem of his, on the nature and quality of birds, ſerpents, and herbs; which he ſays Macer being then very old had often read to him:

Sæpe ſuas volucres legit mibi grandior ævo,
Quæque nocet ſerpens, quæ juvat herba, Macer.
De Ponto, lib. iv. eleg. 10.

There is extant a poem upon the nature and power of herbs under Macer's name; but it is ſpurious. He alſo wrote a ſupplement to Homer, as Quintus Calaber did afterwards in Greek:

Tu canis æterno quicquid reſtabat Homero:
Ne careant ſumma Troica bella manu.
De Ponto, lib. ii. eleg 10.

MACERATION, is an infuſion of, or ſoaking ingredients in water or any other fluid, in order either to ſoften them or draw out their virtues.

MACERATA, a handſome and populous town of Italy, in the territory of the church, and in the Marche of Ancona, with a biſhop's ſee, and an univerſity. It is ſeated near the mountain Chiento, in E. Long. 13. 37. N. Lat. 43. 15.

MACHAON, a celebrated phyſician among the ancients, ſon of Æſculapius and brother to Podalirus. He went to the Trojan war with the inhabitants of Trica, Ithome, and Œchalia. According to ſome, he was king of Meſſenia. He was phyſician to the Greeks, and healed the wounds which they received during the Trojan war. Some ſuppoſe he was killed before Troy by Eurypylus the ſon of Telephus. He received divine honours after death, and had a temple in Meſſenia.

MACHÆRUS (anc. geog.), a citadel on the other ſide Jordan, near the mountains of Moab, not far from and to the north of the *Lacus Aſphaltites*. It was the ſouth boundary of the Peræa: ſituated on a mountain encompaſſed round with deep and broad valleys; built by Alexander king of the Jews, deſtroyed by Gabinius in the war with Ariſtobulus, and rebuilt by Herod with a cognominal town round it. Here John the Baptiſt was beheaded (Joſephus).

MACHIAN, one of the Molucca iſlands, in the Eaſt India Ocean, about 20 miles in circumference, and the moſt fertile of them all. It likewiſe produces the beſt cloves; and is in poſſeſſion of the Dutch, who have three ſtrong forts built on it.

MACHIAVEL (Nicholas), a famous political writer of the 16th century, was born of a diſtinguiſhed family at Florence. He wrote in his native language with great elegance and politeneſs, though he underſtood very little of the Latin tongue; but he was in the ſervice of Marcellus Virgilius, a learned man, who pointed out to him many of the beautiful paſſages in the ancients, which Machiavel had the art of placing properly in his works. He compoſed a comedy upon the ancient Greek model; in which he turned into ridicule many of the Florentine ladies, and which was ſo well received, that Pope Leo X. cauſed it to be acted at Rome. Machiavel was ſecretary, and afterwards hiſtoriographer, to the republic of Florence. The houſe of Medicis procured him this laſt office, together with a handſome ſalary, in order to pacify his reſentment for having ſuffered the torture upon ſuſpicion of being an accomplice in the conſpiracy of the Soderini againſt that houſe, when Machiavel bore his ſufferings without making any confeſſion. The great encomiums he beſtowed upon Brutus and Caſſius, both in his converſations and writings, made him ſtrongly ſuſpected of being concerned in another conſpiracy againſt cardinal Julian de Medicis, who was afterwards pope under the name of *Clement VII.* However, they carried on no proceedings againſt him; but from that time he turned every thing into ridicule, and gave himſelf up to irreligion. He died in 1530, of a remedy which he had taken by way of prevention. —Of all his writings, that which has made the moſt noiſe, and has drawn upon him the moſt enemies, is a political treatiſe entitled the *Prince;* which has been tranſlated into ſeveral languages, and wrote againſt by many authors. The world is not agreed as to the motives of this work; ſome thinking, he meant to recommend tyrannical maxims; others, that he only delineated them to excite abhorrence. Machiavel alſo wrote, Reflections on Titus Livius, which are extremely curious; The Hiſtory of Florence, from the year 1205 to 1494; and a quarto volume of Poems and other pieces. Mr Harrington conſiders him as a ſuperior genius, and as the moſt excellent writer on politics and government that ever appeared.

MACHINE, *(Machina)*, in the general, ſignifies any thing that ſerves to augment or to regulate moving powers: Or it is any body deſtined to produce motion, ſo as to ſave either time or force. The word comes from the Greek μαχανη, machine, invention, art:" and hence, in ſtrictneſs, a machine is ſomething that conſiſts more in art and invention, than in the ſtrength and ſolidity of the materials; for which reaſon it is that the inventors of machines are called *ingenieurs* or *engineers.*

Machines are either ſimple or compound. The ſimple ones are the ſeven mechanical powers, viz. lever, balance, pully, axis and wheel, wedge, ſcrew, and inclined plane. See Mechanics.

From theſe the compound ones are formed by various combinations, and ſerve for different purpoſes. See Mechanics and Hydrostatics; alſo the articles Agriculture, Cannon, Centrifugal, Fire, Steam, Furnace, Burroughs, Ramsden, &c. &c.

Machines uſed in war amongſt the Greeks, were principally theſe: 1. Κλιμακες, or ſcaling ladders; 2. The battering ram; 3. The *helepolis;* 4. The χελωνη or tortoiſe, called by the Romans *teſtudo;* 5. The χωμα or *agger*, which was faced with ſtone, and raiſed higher than the wall; 6. Upon the χωμα were built πυργοι or towers of wood; 7. Γερραι, or oſier hurdles; 8. *Catapultæ*, or καταπελται, from which they threw arrows with amazing force; and 9. The λιθοϐολοι, πετρωϐολοι, or αφετηρια, from which ſtones were caſt with great velocity.

The principal warlike machines made uſe of by the Romans were, the ram, the *lupus* or wolf, the *teſtudo* or tortoiſe, the *baliſta*, the *catapulta*, and the *ſcorpion.*

MACHINERY, in epic and dramatic poetry, is when the poet introduces the uſe of machines; or brings ſome ſupernatural being upon the ſtage, in order to ſolve ſome difficulty or to perform ſome exploit out of the reach of the human power.

The ancient dramatic poets never made uſe of machines, unleſs where there was an abſolute neceſſity for ſo doing: whence the precept of Horace;

> *Nec Deus interſit, niſi dignus vindice nodus*
> *Inciderit.*

It is quite otherwiſe with epic poets, who introduce machines in every part of their poems; ſo that nothing is done without the intervention of the gods. In Milton's Paradiſe Loſt, by far the greater part of the actors are ſupernatural perſonages: Homer and Virgil do nothing without them; and in Voltaire's Henriade, the poet has made uſe of St Louis.

As to the manner in which theſe machines ſhould act, it is ſometimes inviſibly, by ſimple inſpirations and ſuggeſtions; ſometimes by actually appearing under ſome human form; and, laſtly, by means of dreams and oracles, which partake of the other two. However, all theſe ſhould be managed in ſuch a manner as to keep within the bounds of probability.

Plate CCLXXIX.

MACHUL, an inſtrument of muſic among the Hebrews. Kircher apprehends that the name was given to two kinds of inſtruments, one of the ſtringed and the other of the pulſatile kind. That of the former ſort had ſix chords: though there is great reaſon to doubt whether an inſtrument requiring the aid of the hair bow, and ſo much reſembling the violin, be ſo ancient. The ſecond kind was of a circular form, made of metal, and either hung round with little bells, or furniſhed with iron rings ſuſpended on a rod or bar that paſſed acroſs the circle. Kircher ſuppoſes that it was moved to and fro by a handle fixed to it, and thus emitted a kind of murmur.

MACHYNLETH, a town of Montgomeryſhire in North Wales, 198 miles from London, and 32 from Montgomery. It is an ancient town; and has a market on Mondays, and fairs on May 16, June 26, July 9, September 18, and November 25, for ſheep, horned cattle, and horſes. It is ſeated on the river Douay, over which there is a large ſtone bridge, which leads into Merionethſhire. It was here that Owen Glyndwr exerciſed the firſt acts of his royalty in 1402.

Here he accepted the crown of Wales, and aſſembled a parliament; and the houſe wherein they met is now ſtanding, divided into tenements.

MACKENZIE, (Sir George), an able lawyer, a polite ſcholar, and a celebrated wit, was born at Dundee in the county of Angus in Scotland in 1636, and ſtudied at the univerſities of Aberdeen and St Andrew's; after which he applied himſelf to the civil law, travelled into France, and proſecuted his ſtudy in that faculty for about three years. At his return to his native country, he became an advocate in the city of Edinburgh; and ſoon gained the character of an eminent pleader. He did not however, ſuffer his abilities to be confined entirely to that province. He had a good taſte for polite literature; and he gave the public, from time to time, inconteſtable proofs of an uncommon proficiency therein. He had practiſed but a few years, when he was promoted to the office of a judge in the criminal court; and, in 1674, was made king's advocate, and one of the lords of the privy council in Scotland. He was alſo knighted by his majeſty. In theſe ſtations he met with a great deal of trouble, on account of the rebellions which happened in his time; and his office of advocate requiring him to act with ſeverity, he did not eſcape being cenſured, as if in the deaths of ſome particular perſons who were executed he had ſtretched the laws too far. But there does not ſeem to have been any juſt foundation for this clamour againſt him; and it is generally agreed, that he acquitted himſelf like an able and upright magiſtrate. Upon the abrogation of the penal laws by king James II. our advocate, though he had always been remarkable for his loyalty, and even cenſured for his zeal againſt traitors and fanatics, thought himſelf obliged to reſign his poſt; being convinced, that he could not diſcharge the duties of it in that point with a good conſcience. But he was ſoon after reſtored, and held his offices till the revolution; an event which, it ſeems, he could not bring himſelf to approve. He had hoped that the prince of Orange would have returned to his own country when matters were adjuſted between the king and his ſubjects; and upon its proving otherwiſe, he quitted all his employments in Scotland, and retired into England, reſolving to ſpend the remainder of his days in the univerſity of Oxford. He arrived there in September 1689, and proſecuted his ſtudies in the Bodleian library, being admitted a ſtudent there by a grace paſſed in the congregation, June 2. 1690. In the ſpring following, he went to London; where he fell into a diſorder, of which he died in May 1691. His corpſe was conveyed by land to Scotland, and interred there with great pomp and ſolemnity. "The politeneſs of his learning, and the ſprightlineſs of his wit, were (ſays the reverend Mr Granger) conſpicuous in all his pleadings, and ſhone in his ordinary converſation." Mr Dryden acknowledges, that he was unacquainted with what he calls the *beautiful turn of words and thoughts in poetry*, till they were explained and exemplified to him in a converſation with that noble wit of Scotland Sir George Mackenzie.—He wrote ſeveral pieces of hiſtory and antiquities; Inſtitutions of the laws of Scotland; Eſſays upon various ſubjects, &c. His works were printed together at Edinburgh in 1716, in 2 vols folio.

MACKEREL, in ichthyology. See SCOMBER.

MACKEY (John,) an Engliſhman, employed by the government as a ſpy upon James II. after the revolution, was author of Memoirs of James's court at St Germaine, and of the court of England in the reigns of William III. and queen Anne; in which are many curious anecdotes not to be met with in any other work. He died in 1726.

MACLAURIN (Colin), a moſt eminent mathematician and philoſopher, was the ſon of a clergyman, and born at Kilmoddan in Scotland in 1698. He was ſent to the univerſity of Glaſgow in 1709; where he continued five years, and applied himſelf to ſtudy in a moſt intenſe manner. His great genius for mathematical learning diſcovered itſelf ſo early as at twelve years of age; when, having accidentally met with an Euclid in a friend's chamber, he became in a few days maſter of the firſt ſix books without any aſſiſtance: and it is certain, that in his 16th year he had invented many of the propoſitions which were afterwards publiſhed under the title of *Geometria organica*. In his 15th year he took the degree of maſter of arts; on which occaſion he compoſed and publicly defended a theſis On the power of Gravity, with great applauſe. After this he quitted the univerſity, and retired to a country-ſeat of his uncle, who had the care of his education; for his parents had been dead ſome time. Here he ſpent two or three years in purſuing his favourite ſtudies; but, in 1717, he offered himſelf a candidate for the profeſſorſhip of mathematics in the Mariſchal college of Aberdeen, and obtained it after a ten days trial with a very able competitor. In 1719, he went to London, where he became acquainted with Dr Hoadly then biſhop of Bangor, Dr Clarke, Sir Iſaac Newton, and other eminent men; at which time alſo he was admitted a member of the Royal Society: and in another journey in 1721, he contracted an intimacy with Martin Folkes, Eſq. the preſident of it, which laſted to his death.

In 1722, lord Polwarth, plenipotentiary of the king of Great-Britain at the congreſs of Cambray, engaged him to go as a tutor and companion to his eldeſt ſon, who was then to ſet out on his travels. After a ſhort ſtay at Paris, and viſiting other towns in France, they fixed in Lorrain; where Maclaurin wrote his piece On the Percuſſion of Bodies, which gained the prize of the royal academy of ſciences for the year 1724. But his pupil dying ſoon after at Montpelier, he returned immediately to his profeſſion at Aberdeen. He was hardly ſettled here, when he received an invitation to Edinburgh; the curators of that univerſity being deſirous that he ſhould ſupply the place of Mr James Gregory, whoſe great age and infirmities had rendered him incapable of teaching. He had ſome difficulties to encounter, ariſing from competitors, who had good intereſt with the patrons of the univerſity, and alſo from the want of an additional fund for the new profeſſor; which however at length were all ſurmounted, principally by the means of Sir Iſaac Newton. In Nov. 1725, he was introduced into the univerſity; as was at the ſame time his learned colleague and intimate friend, Dr Alexander Monro, profeſſor of anatomy. After this, the mathematical claſſes ſoon became very numerous, there being generally upwards of 100 young gentlemen attending his lectures every year; who being of different ſtandings and proficiency, he was obliged to divide them into four or five claſſes, in each of which he employed a full hour every day, from the firſt of November to the firſt of June.

He lived a bachelor to the year 1733: but being not leſs formed for ſociety than for contemplation, he then married Anne, the daughter of Mr Walter Stewart ſolicitor-general to his late majeſty for Scotland. By this lady he had ſeven children, of whom two ſons and three daughters, together with his wife, ſurvived him. In 1734, Berkeley, biſhop of Cloyne, publiſhed a piece called "The analyſt;" in which he took occaſion, from ſome diſputes that had ariſen concerning the grounds of the fluxionary method, to explode the method itſelf, and alſo to charge mathematicians in general with infidelity in religion. Maclaurin thought himſelf included in this charge, and began an anſwer to Berkeley's book: but, as he proceeded, ſo many diſcoveries, ſo many new theories and problems occurred to him, that inſtead of a vindicatory pamphlet, his work came out, A complete ſyſtem of Fluxions, with their application to the moſt conſiderable problems in geometry and natural philoſophy. This work was publiſhed at Edinburgh in 1742, 2 vols 4to; and as it coſt him infinite pains, ſo it is the moſt conſiderable of all his works, and will do him immortal honour. In the mean time, he was continually obliging the public with ſome performance or obſervation of his own; many of which were publiſhed in the fifth and ſixth volumes of the "Medical Eſſays" at Edinburgh. Some of them were likewiſe publiſhed in the Philoſophical Tranſactions; as the following: 1. Of the conſtruction and meaſure of curves, N° 356. 2. A new method of deſcribing all kinds of curves, N° 359. 3. A letter to Martin Folkes, Eſq; on equations with impoſſible roots, May 1726, N° 394. 4. Continuation of the ſame, March 1729, N° 408. 5. December the 21ſt, 1732, on the deſcription of curves; with an account of farther improvements, and a paper dated at Nancy, Nov. 27, 1722, N° 439. 6. An account of the treatiſe of fluxions, Jan. 27, 1742, N° 467. 7. The ſame continued, March 10, 1742, N° 469. 8. A rule for finding the meridional parts of a ſpheroid with the ſame exactneſs as of a ſphere, Auguſt 1741, N° 461. 9. Of the baſis of the cells wherein the bees depoſite their honey; Nov. 3. 1734. N° 471.

In the midſt of theſe ſtudies, he was always ready to lend his aſſiſtance in contriving and promoting any ſcheme which might contribute to the ſervice of his country. When the earl of Morton ſet out in 1739 for Orkney and Shetland, to viſit his eſtates there, he deſired Mr Maclaurin to aſſiſt him in ſettling the geography of thoſe countries, which is very erroneous in all the maps; to examine their natural hiſtory, to ſurvey the coaſts, and to take the meaſure of a degree of the meridian. Maclaurin's family affairs, and other connections, would not permit him to do this: he drew, however, a memorial of what he thought neceſſary to be obſerved, furniſhed the proper inſtruments, and recommended Mr Short, the famous optician, as a fit operator for the management of them. He had ſtill another ſcheme for the improvement of geography and navigation, of a more extenſive nature; which was the opening a paſſage from Greenland to the South Sea by the north pole. That ſuch a paſſage might be found, he was ſo fully perſuaded, that he has been heard to ſay, if his ſituation could admit of ſuch adventures, he would undertake the voyage, even at his own charge. But when ſchemes for finding it were laid before the parliament in 1744, and himſelf conſulted by ſeveral perſons of high rank concerning them, before he could finiſh the memorials he propoſed to ſend, the premium was limited to the diſcovery of a North-weſt paſſage: and he uſed to regret, that the word Weſt was inſerted, becauſe he thought that paſſage, if at all to be found, muſt lie not far from the pole.

In 1745, having been very active in fortifying the city of Edinburgh againſt the rebel army, he was obliged to fly from thence to the north of England; where he was invited by Herring, then archbiſhop of York, to reſide with him during his ſtay in that country. In this expedition, however, being expoſed to cold and hardſhips, and naturally of a weak and tender conſtitution, he laid the foundation of an illneſs which put an end to his life, in June 1746, at the age of 48.

Mr Maclaurin was a very good as well as a very great man, and worthy of love as well as admiration. His peculiar merit as a philoſopher was, that all his ſtudies were accommodated to general utility; and we find, in many places of his works, an application even of the moſt abſtruſe theories, to the perfecting of mechanical arts. He had reſolved, for the ſame purpoſe, to compoſe a courſe of practical mathematics, and to reſcue ſeveral uſeful branches of the ſcience from the bad treatment they often met with in leſs ſkilful hands. But all this his death prevented; unleſs we ſhould reckon, as a part of his intended work, the tranſlation of Dr David Gregory's "Practical Geometry," which he reviſed, and publiſhed with additions, 1745. In his lifetime, however, he had frequent opportunities of ſerving his friends and his country by his great ſkill. Whatever difficulty occurred concerning the conſtructing or perfecting of machines, the working of mines, the improving of manufactures, the conveying of water, or the execution of any other public work, he was at hand to reſolve it. He was likewiſe employed to terminate ſome diſputes of conſequence that had ariſen at Glaſgow concerning the gauging of veſſels; and for that purpoſe preſented to the commiſſioners of exciſe two elaborate memorials, with their demonſtrations, containing rules by which the officers now act. He made alſo calculations relating to the proviſion, now eſtabliſhed by law, for the children and widows of the Scots clergy, and of the profeſſors in the univerſities, intitling them to certain annuities and ſums, upon the voluntary annual payment of a certain ſum by the incumbent. In contriving and adjuſting this wiſe and uſeful ſcheme, he beſtowed a great deal of labour, and contributed not a little towards bringing it to perfection. It may be ſaid of ſuch a man, that "he lived to ſome purpoſe;" which can hardly be ſaid of thoſe, how uncommon ſoever their abilities and attainments, who ſpend their whole time in abſtract ſpeculations, and produce nothing to the real uſe and ſervice of their fellow creatures.

Of his works we have mentioned his *Geometria Organica*, in which he treats of the deſcription of curve lines by continued motion. We need not repeat what has

has been ſaid concerning his piece which gained the prize of the royal academy of ſciences in 1724. In 1740, the academy adjudged him a prize, which did him ſtill more honour, for ſolving the motion of the tides from the theory of gravity; a queſtion which had been given out the former year, without receiving any ſolution. He had only ten days to draw this paper up in, and could not find leiſure to tranſcribe a fair copy; ſo that the Paris edition of it is incorrect. He afterwards reviſed the whole, and inſerted it in his Treatiſe of Fluxions; as he did alſo the ſubſtance of the former piece. Theſe, with the treatiſe of Fluxions, and the pieces printed in the Philoſophical Tranſactions, of which we have given a liſt, are all the writings which our author lived to publiſh. Since his death, two volumes more have appeared; his Algebra, and his Account of Sir Iſaac Newton's Philoſophical diſcoveries. His Algebra, though not finiſhed by himſelf, is yet allowed to be excellent in its kind; containing, in no large volume, a complete elementary treatiſe of that ſcience, as far as it has hitherto been carried. His account of Sir Iſaac Newton's Philoſophy was occaſioned in the following manner: Sir Iſaac dying in the beginning of 1728, his nephew, Mr Conduitt, propoſed to publiſh an account of his life, and deſired Mr Maclaurin's aſſiſtance. The latter, out of gratitude to his great benefactor, cheerfully undertook, and ſoon finiſhed, the hiſtory of the progreſs which philoſophy had made before Sir Iſaac's time, and this was the firſt draught of the work in hand; which not going forward, on account of Mr Conduitt's death, was returned to Mr Maclaurin.—To this he afterwards made great additions, and left it in the ſtate in which it now appears. His main deſign ſeems to have been, to explain only thoſe parts of Sir Iſaac's philoſophy which have been, and ſtill are, controverted: and this is ſuppoſed to be the reaſon why his grand diſcoveries concerning light and colours are but tranſiently and generally touched upon. For it is known, that ever ſince the experiments, on which his doctrine of light and colours is founded, have been repeated with due care, this doctrine has not been conteſted; whereas his accounting for the celeſtial motions, and the other great appearances of nature, from gravity, is miſunderſtood, and even ridiculed by ſome to this day.

MACQUER (Philippe), advocate of the parliament of Paris, where he was born in 1720, being deſcended from a reſpectable family. A weakneſs in his lungs having prevented him from engaging in the laborous exerciſes of pleading, he dedicated himſelf to literary purſuits, His works are, 1. *L'Abregé Chronologique de l'Hiſtoire Eccleſiaſtique*, 3 vols. 8vo. written in the manner of the Preſident Henault's Hiſtory of France, but not poſſeſſed of equal ſpirit and elegance. 2. *Les Annales Romaines*, 1756, 8vo; another chronological abridgement, and much better ſupported than the former. Into this work the author has introduced every thing moſt worthy of notice which has been written by Saint Evremond, Abbé Saint-Real, Preſident Monteſquieu, Abbé Mably, &c. concerning the Romans; and, if we except a difference of Style, which is eaſily diſcernible, it is, in other reſpects, a very judicious compilation. 3. *Abregé Chronologique de l'Hiſtoire d'Eſpagne & de Portugal*, 1759, 1765, in two vols. 8vo. This book, in point of accuracy, is worthy of the Preſident Henault, by whom it was begun; but it diſplays no diſcrimination of character nor depth of reſearch. The author received aſſiſtance from M. Lacombe, whoſe talents for chronological abridgement are well known. The republic of letters ſuſtained a loſs by the death of M. Macquer, which happened on the 27th of January 1770, at the age of 50. As to his character, he was induſtrious, agreeable, modeſt, and ſincere, and an enemy to all fooliſh vanity and affectation. He had a cold imagination, but a correct taſte. He had an eager thirſt for knowledge of every kind, and he had neglected no uſeful branch of ſtudy. He had a ſhare in the Dictionary of Arts and Profeſſions, in 2 vols 8vo, and in the Tranſlation of the Syphilis of Fracaſtor publiſhed by Lacombe.

MACQUER (Pierre Joſeph), brother to the former, was born at Paris the 9th of October 1718, and died there February 16th 1784. He was a member of the academy of ſciences, and late profeſſor of pharmacy; was engaged in the *Journal de Sçavans*, for the articles of medicine and chemiſtry. With the latter ſcience he was intimately acquainted. He had a ſhare in the *Pharmacopœia Pariſienſis*, publiſhed in 1758, in 4to. His other works are, 1. *Elemens de Chemie theorique*; Paris, 1749, 1753, 12mo; which have been tranſlated into Engliſh and German.—3. *Elemens de Chemie pratique*, 1751, 12mo. Theſe two works were re publiſhed together, in 1756, in 3 vols 12mo. 3. *Plan d'un cours de Chemie experimentale & raiſonée*, 1757, 12mo; in the compoſition of which he was aſſociated with M. Beaumé. 4. *Formulæ Medicamentorum Magiſtralium*, 1763. 5. *L'Art de la Teinture en Soie*, 1763.—6. *Dictionaire de Chemie, contenant la théorie & la pratique de cet art*, 1766, 2 vols 8vo; which has been tranſlated into German, with notes; and into Engliſh, with notes, by Mr Keir. Macquer has, by his labours and writings, greatly contributed to render uſeful an art which formerly tended only to ruin the health of the patient by foreign remedies, or to reduce the profeſſors of it to beggary, while they proſecuted the idle dreams of converting every thing into gold.

MACRIN (Salmon), one of the beſt Latin poets of the 16th century, was born at London. His true name was *John Salmon*; but he took that of *Macrin*, from his being frequently ſo called in ridicule by Francis I. on account of his extraordinary leanneſs. He was preceptor to Cladius of Savoy, count of Tende; and to Honorius the count's brother; and wrote ſeveral pieces of poetry in lyric verſe, which were ſo admired, that he was called *the Horace of his time*. He died of old age, at London, in 1555.--*Charles* MACRIN, his ſon was not inferior to him as a poet, and ſurpaſſed him in his knowledge of the Greek tongue. He was preceptor to Catharine of Navarre, the ſiſter of Henry the Great; and periſhed in the maſſacre on St Bartholomew's day in 1572.

MACROBII, a people of Ethiopia, celebrated for their juſtice, and the innocence of their manners, alſo a people in the iſland Meröe. The Hyperboreans were alſo called Macrobii: They generally lived to their 120th year; and from their longevity they obtained their name (μακρος βιος, *long life*.)

MACROBIUS (Ambroſius Aurelius Theodoſius), an ancient Latin writer, who flouriſhed towards the latter part of the fourth century.—Of what country he was, is not clear: Eraſmus, in his Ciceronianus, ſeems to think he was a Greek; and he himſelf tells us, in the preface to his Saturnalia, that he was not a Roman, but laboured under the inconveniences of writing in a language which was not natural to him. Of what religion he was, Chriſtian or Pagan, is uncertain. Barthius ranks him among the Chriſtians; but Spanheim and Fabricius ſuppoſe him to have been a heathen. This, however, is certain, that he was a man of conſular dignity, and one of the chamberlains or maſters of the wardrobe to Theodoſius; as appears from a reſcript directed to Florentius, concerning thoſe who were to obtain that office. He wrote a commentary upon Cicero's *Somnium Scipionis*, and ſeven books of *Saturnalia*, which treat of various ſubjects, and are an agreeable mixture of criticiſm and antiquity. He was not an original writer, but made great uſe of other people's works, borrowing not only their materials, but even their language, and for this he has been ſatirically rallied by ſome modern authors, though rather unfairly, conſidering the expreſs declaration and apology which he makes on this head, at the very entrance of his work. "Don't blame me," ſays he, "if what I have collected from multifarious reading, I ſhall frequently expreſs in the very words of the authors from whom I have taken it: for my view in this preſent work is, not to give proofs of my eloquence, but to collect and digeſt into ſome regularity and order ſuch things as I thought might be uſeful to be known. I ſhall therefore here imitate the bees, who ſuck the beſt juices from all ſorts of flowers, and afterwards work them up into various forms and orders, with ſome mixture of their own proper ſpirit." The *Somnium Scipionis* and *Saturnalia* have been often printed; to which has been added, in the later editions, a piece intituled, *De Differentiis & Societatibus Græci Latinique Verbi.*

MACROCEPHALUS, (Compounded of μακρος "great," and κεφαλη "head," denotes a perſon with a head larger or longer than the common ſize. Macrocephali, or Long-heads, is a name given to a certain people, who, according to the accounts of authors, were famous for the unſeemly length of their heads: yet cuſtom ſo far habituated them to it, that inſtead of looking on it as a deformity, they eſteemed it a beauty, and, as ſoon as the child was born, moulded and faſhioned its head in their hands to as great a length as poſſible, and afterward uſed all ſuch rollers and bandages as might ſeem moſt likely to determine its growing long. The greater part of the iſlanders in the Archipelago, ſome of the people of Aſia, and even ſome of thoſe of Europe, ſtill preſs their childrens heads out lengthwiſe. We may obſerve alſo, that the Epirots, many people of America, &c. are all born with ſome ſingularity in the conformation of their heads; either a flatneſs on the top, two extraordinary protuberances behind, or one on each ſide; ſingularities which we can only regard as an effect of an ancient and ſtrange mode, which at length is become hereditary in the nation. According to the report of many travellers, the operation of compreſſing the head of a child lengthwiſe, while it is yet ſoft, is with a view inſenſibly to enlarge the interval between the two eyes, ſo that the viſual rays turning more to the right and left, the ſight would embrace a much larger portion of the horizon; the advantage of which they are well acquainted with, either in the conſtant exerciſe of hunting, or on a thouſand other occaſions. Ever ſince the 16th century, the miſſionaries eſtabliſhed in the countries inhabited by the ſavages of America, have endeavoured to deſtroy this cuſtom; and we find in the ſeſſions of the third council of Lima, held in 1585, a canon which expreſsly prohibits it. But if it has been repreſſed one way, the free negroes and Maroons, although Africans, have adopted it, ſince they have been eſtabliſhed among the Caribbs, ſolely with the view of diſtinguiſhing their children, which are born free, from thoſe who are born in ſlavery. The Omaquas, a people of South America, according to P. Veigh, preſs the heads of their children ſo violently between two planks that they become quite ſharp at the top, and flat before and behind. They ſay they do this to give their heads a greater reſemblance to the moon.

MACROCERCI, a name given to that claſs of animalcules which have tails longer than their bodies.

MACROCOLUM, or MACROCOLLUM (formed of μακρος "large," and κολλαω "I join,") among the Romans, the largeſt kind of paper then in uſe. It meaſured ſixteen inches, and frequently two feet.

MACROCOSM, a word denoting the great world or univerſe. It is compounded of the Greek words μακρος "great," and κοσμος "world."

MACROMP, or MACROOM, a town of Ireland, in the barony or Muſkerry, county of Cork, and province of Munſter, 142 miles from Dublin; it is ſituated amongſt hills, in a dry gravelly limeſtone ſoil.—This place is ſaid to take its name from an old crooked oak, ſo called in Iriſh, which formerly grew here. The caſtle was firſt built in King John's time, ſoon after the Engliſh conqueſt, (according to Sir Richard Cox) by the Carews, but others attribute it to the Daltons. It was repaired and beautified by Teague Macarty, who died in the year 1565, and was father to the celebrated Sir Cormac Mac Teague mentioned by Cambden and other writers as an active perſon in Queen Elizabeth's time. The late Earls of Glancarty altered this caſtle into a more modern ſtructure, it being burnt down in the wars of 1641. Oppoſite to the bridge, is the pariſh-church, dedicated to St Colman of Cloyne. Here is a barrack for a foot company, a market-houſe, and handſome Roman Catholic chapel. A conſiderable number of perſons have been employed in this town in combing wool and ſpinning yarn, and ſome ſalt-works have been erected here. At half a mile's diſtance is a ſpa, that riſes on the very brink of a bog; its waters are a mild chalybeate, and are accounted ſerviceable in hypochondriacal caſes, and in cutaneous eruptions. The fairs are four in the year.

MACROPYRENIUM, in natural hiſtory, a genus of foſſils conſiſting of cruſtated ſeptariæ, with a long nucleus ſtanding out at each end of the maſs.

MACROTELOSTYLA, in natural hiſtory, the name of a genus of cryſtals, which are compoſed of two pyramids joined to the end of a column; both the pyramids, as alſo the column, being hexangular;

and

and the whole body conſequently compoſed of 18 planes.

MACTATIO, in the Roman ſacrifices, ſignifies the act of killing the victim. This was performed either by the prieſt himſelf, or ſome of his inferior officers, whom we meet with under the names of *popæ*, *agones*, *cultrarii*, and *victimarii;* but, before the beaſt was killed, the prieſt turning himſelf to the eaſt, drew a crooked line with his knife, from the forehead to the tail. Among the Greeks this ceremony was performed moſt commonly by the prieſt, or, in his abſence, by the moſt honourable perſon preſent. If the ſacrifice was offered to the celeſtial gods, the victim's throat was bent up towards heaven; if to the infernal, or to heroes, it was killed with its throat towards the ground. The manner of killing the animal was by a ſtroke on the head, and after it was fallen, thruſting a knife into its throat. Much notice was taken, and good or ill ſucceſs predicted, from the ſtruggles of the beaſt, or its quiet ſubmiſſion to the blow, from the flowing of the blood, and the length of time it happened to live after the fall, &c.

MACULÆ, in aſtronomy, dark ſpots appearing on the luminous ſurfaces of the ſun and moon, and even ſome of the planets. See ASTRONOMY, nº 30. and nº 58 *et ſeq.* and nº 98. and nº 121 *et ſeq.*

MAD-APPLE. See SOLANUM.

MADAGASCAR, the largeſt of the African iſlands, is ſituated between 43° and 51° of E. Long. and between 12° and 26° of S. Lat.; extending in length near 1000 miles from north-north-eaſt to ſouth-ſouth-weſt, and about 300 in breadth where broadeſt. It was diſcovered in 1506 by Laurence Almeyda; but the Perſians and the Arabians were acquainted with it from time immemorial under the name of *Serandib.* Alphonſo Albukerque ordered Ruy Pereira dy Conthinto to viſit the interior parts, and that general intruſted Triſtan d'Acunha with the ſurvey. The Portugueſe called it the iſland of *St Laurence*; the French, who viſited it in the reign of Henry IV. named it *Iſle Dauphine*; its proper name is *Madegaſſe.* It is now, however, by common conſent called *Madagaſcar.*

This large iſland, according to many learned geographers is the Cerné of Pliny, and the Menuthiaſde of Ptolemy. It is every where watered by large rivers, ſtreams, and rivulets, which have their ſource at the foot of that long chain of mountains which runs through the whole extent of the iſland from eaſt to weſt. The two higheſt promontories are called *Vivagora* and *Botiſtmene.*

Theſe mountains (according to the Abbe Rochon*) incloſe within their boſoms a variety of precious minerals and uſeful foſſils. The traveller (who for the firſt time rambles over ſavage and mountainous countries, interſected with vallies and with hills, where nature left to herſelf brings forth the moſt ſingular and the moſt varied productions) is involuntarily ſurpriſed and terrified at the ſight of precipices, the ſummits of which are crowned with monſtrous trees, that ſeem coeval with the world. His aſtoniſhment is redoubled at the noiſe of thoſe grand caſcades, the approach to which is generally inacceſſible. But to thoſe views ſo ſublimely pictureſque, rural ſcenes ſoon ſucceed; little hills, gentle riſing grounds, and plains, the vegetation of which is never repreſſed by the intemperance or the viciſſitudes of the ſeaſon. The eye contemplates with pleaſure thoſe vaſt ſavannas which nouriſh numberleſs herds of bullocks and of ſheep. You behold a flouriſhing agriculture, produced almoſt ſolely by the fertiliſing womb of nature. The fortunate inhabitants of Madagaſcar do not bedew the earth with their ſweat; they ſcarce ſtir the ground with a rake, and even that ſlight preparation is ſufficient. They ſcrape little holes at a ſmall diſtance from each other, into which they ſcatter a few grains of rice, and cover them with their feet; and ſo great is the fertility of the ſoil, that the lands ſown in this careleſs manner produce an hundred fold.

The foreſts preſent a prodigious variety of them uſeful and the moſt beautiful trees; ebony, wood for dyeing, bamboos of an enormous thickneſs, and palm trees of every kind. The timber employed in ſhip-building is no leſs common than thoſe kinds ſo much prized by the cabinet-maker. We are told by the French governor Flacourt, in his hiſtory of this iſland†, that in the year 1650 he ſent to France 52,000 weight of aloes of an excellent quality. All of theſe various trees and ſhrubs are ſurrounded by an infinite number of paraſitical plants: muſhrooms of an infinite diverſity of kinds and colours are to be met with every where in the woods; and the inhabitants know well how to diſtinguiſh thoſe which are prejudial to the health. They collect large quantities of uſeful gums and reſins; and out of the milky ſap of a tree, denominated by them *ſinguiore*, the inhabitants by means of coagulation, make that ſingular ſubſtance known to naturaliſts by the name of *gum elaſtic.* (See CAOUTCHOUC and JATROPHA.)

Beſides the aromatic and medicinal herbs which abound in the foreſts, the iſland produces flax and hemp of a length and ſtrength which ſurpaſs any in Europe. Sugar canes, wax, honey of different kinds, tobacco, indigo, white pepper, gum lac, ambergris, ſilk, and cotton, would long ſince have been objects of commerce, which Madagaſcar would have yielded in profuſion, if the Europeans, in viſiting the iſland, had furniſhed the inhabitants with the neceſſary information for preparing and improving theſe ſeveral productions.

The ſugar-canes (as we are informed by another traveller||) are much larger and finer than any in the Weſt Indies; being as thick as a man's wriſt, and ſo full of juice, that a foot of them will weigh two pounds. When the natives travel, they carry a ſugar-cane along with them, which will ſupport them for two or three days. Here are alſo plenty of tamarinds; and ſuch quantities of limes and oranges, that very large caſks may be filled with their juices at a trifling expence, as they may be purchaſed for iron-pots, muſkets, powder, ball, &c. During the ſhort time that Admiral Watſon's ſquadron ſtaid here in 1754, Mr Ives preſerved about half a hogſhead full of thoſe juices, which proved afterwards of the greateſt ſervice to the ſhips crews. It muſt be obſerved, however, that no good water is to be had at St Auguſtine in the ſouth-weſt part of the iſland, where ſhips uſually touch, unleſs boats are ſent for it four or five miles up the river; and inſtead of filling their caſks at low water (as is the caſe in moſt other rivers), they muſt begin to fill at

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* *Voyage a Madagaſcar, &c*, Par. 1791.

† *Hiſt. de la Grand Iſle de Madag.* Paris 1660.

|| *Ives's Voyage to India*, p. 14.

about a quarter's flood: The reaſon aſſigned for this is, that the river has a communication with the ſea at other places beſides this of St Auguſtine's bay; and it has been found by experience, that the ſea-water brought into the river by the flood-tide is not diſcharged till a quarter's flood of the next tide in St Auguſtine's bay, and for three miles up the river, the water is always very brackiſh, if not quite ſalt.

The abundance and variety of proviſions of every kind, which a fine climate and fertile ſoil can produce, are on no part of the globe, according to M. Rochon, ſuperior to thoſe of Madagaſcar: game, wild-fowl, poultry, fiſh, cattle, and fruits, are alike plentiful. The oxen, Mr Ives alſo informs us, are large and fat, and have each a protuberance of fat between the ſhoulders, weighing about 20 pounds. Their fleſh is greatly eſteemed by all the European nations trading to India, and ſhips are ſent to Madagaſcar on purpoſe to kill and ſalt them on the iſland. The protuberance of fat abovementioned is particularly eſteemed after it has lain ſome time in ſalt; but our author ſays, that he could not join in the encomiums either on this piece or the beef in general; as the herbage on which the creatures feed gives their fleſh a particular taſte, which to him was diſagreeable. The ſheep differ little from the goats; being equally hairy, only that their heads are ſomewhat larger: their necks reſemble that of a calf, and their tails weight at leaſt ten pounds. Vaſt quantities of locuſts riſe here from the low lands in thick clouds, extending ſometimes to an incredible length and breadth. The natives eat theſe inſects, and even prefer them to their fineſt fiſh. Their method of dreſſing them is to ſtrip off their legs and wings, and fry them in oil.

The inhabitants (termed *Melagaches* or *Madecaſſes*), M. Rochon informs us, are in perſon above the middle ſize of Europeans. The colour of the ſkin is different in different tribes: among ſome it is of a deep black, among others tawny; ſome of the natives are of a copper colour, but the complexion of by far the greateſt number is olive. All thoſe who are black have woolly hair like the negroes of the coaſt of Africa: thoſe, on the other hand who reſemble Indians or Mulattoes, have hair equally ſtraight with that of the Europeans; the noſe is not broad and flat; the forehead is large and open; in ſhort, all the features are regular and agreeable. Their phyſiognomy diſplays the appearance of frankneſs and of ſatisfaction: they are deſirous only of learning ſuch things as may adminiſter to their neceſſities; that ſpecies of knowledge which demands reflection is indifferent to them; ſober, agile, active, they ſpend the greateſt part of their time either in ſleep or in amuſement. In fine, according to the abbé, the natives of Madagaſcar, like ſavages in general, poſſeſs a character equally devoid of vice and virtue; the gratifications of the preſent moment ſolely occupy his reflections; he poſſeſſes no kind of foreſight whatever; and he cannot conceive the idea that there are men in the world who trouble themſelves about the evils of futurity.

The population of the iſland has been eſtimated at four millions; but this calculation is thought exaggerated by our author, and indeed it appears incredible to us. Every tribe or ſociety inhabits its own canton, and is governed by its own cuſtoms. Each of theſe acknowledges a chief; this chief is ſometimes elective, but more uſually hereditary. The lands are not divided and portioned out, but belong to thoſe who are at the trouble of cultivating them. Theſe iſlanders make uſe of neither locks nor keys; the principal part of their food conſiſts in rice, fiſh, and fleſh; their rice is moiſtened with a ſoup which is ſeaſoned with pimento, ginger, ſaffron, and aromatic herbs. They diſplay wonderful cunning in catching a variety of birds, many of which are unknown in Europe: they have the pheaſant, the partridge, the quail, the pintado, the wild duck, teal of five or ſix different kinds, the blue hen, the black paroquet, and the turtle-dove, in great plenty; and alſo a bat of a monſtrous ſize, which is much prized on account of its exquiſite flavour. Theſe laſt are ſo hideous in their appearance, that they at firſt terrify the European ſailors; but after they have vanquiſhed their repugnance to them, they prize their fleſh infinitely before that of the pullet of their own country. The Melagaches alſo catch an immenſe quantity of ſea-fiſh; ſuch as the dorado, the ſole, the herring, the mackarel, the turtle, &c. with oyſters, crabs, &c. The rivers afford excellent eels, and mullets of an exquiſite flavor.

The inhabitants near St Auguſtine's bay, Mr Ives informs us, ſpeak as much broken Engliſh as enables them to exchange their proviſions for European articles. Theſe, on the part of the Melagaches, are cattle poultry, milk, fruit, rice, ſalt, porcelain, potatoes, yams, fiſh, lances, and ſhells. From the Europeans they receive muſkets, powder, bullets, flints, *clouties*, (including handkerchiefs, and linen of all kinds), beads, iron pots, &c. Silver, which they call *Manila*, is in great eſteem with them, and is made by them into bracelets for their wives.

That part of the iſland at which the Engliſh ſquadron touched, is the dominions of the king of *Baba*, who, by the account of Mr Ives, ſeemed greatly to affect to be an Engliſhman. They had no ſooner touched at the iſlands, than they were waited on by one called *Robin Hood*, and another perſon, both of whom bore the office of *purſers*. Along with theſe were *Philibey* the general; John Anderſon and Frederic Martin, captains. Nor did the king himſelf and his family diſdain to pay them a viſit; who in like manner, were diſtinguiſhed by Engliſh names; the king's eldeſt ſon being called the prince of Wales, and the court not being without a duke of Cumberland, a prince Auguſtus, princeſſes, &c. as in England. All theſe grandees came on board naked, excepting only a ſlight covering above their loins and on their ſhoulders, made of a kind of graſs growing on the iſland; which they had adorned with ſmall glaſs beads by way of border or fringe. Their hair reſembled that of the Indians in being long and black, rather than the woolly heads of the African negroes. The wives of the Melagaches (according to our author) take great pains with their huſbands hair; ſometimes putting it in large and regular curls; at other times braiding it in great order, and making it ſhine with a particular oil which the iſland produces. The men always carry in their hands a wooden lance headed with iron, which is commonly made very neat; and they are ſuch excellent markſmen, that they will ſtrike with it a very

ſmall

ſmall object at 30 or 40 yards diſtance. They have alſo commonly a muſket, which they get from Europeans in exchange for cattle, and are always ſure to keep it in excellent order. I am ſorry to ſay (continues Mr Ives) that the Engliſh are frequently guilty of great impoſitions in this kind of traffic, by diſpoſing of cheap and ill tempered barrels among the poor inhabitants, who ſometimes loſe their lives by the burſting of theſe pieces. Such iniquitous practices as theſe muſt in the end prove injurious to the nation; and has indeed already made the name of more than one half of theſe traders truly infamous among the deluded but hitherto friendly Madagaſcarians.

"They are a civil and good-natured people, but eaſily provoked, and apt to ſhow their reſentment on the leaſt provocation, eſpecially when they think themſelves injured or ſlighted. Another characteriſtic of them is, the very high notions of dignity they entertain of their king; which is carried to ſuch a height, that they are never more ſenſibly hurt than when they imagine he is treated with incivility or diſreſpect. This mighty monarch reſides in a town built with mud, about 12 miles up the country from St Auguſtine's Bay. On the eaſt ſide of the bay, as you enter, there reſided one Prince William, a relation and tributary to the king; but who in moſt caſes acted as an independent prince, and always uſed his utmoſt endeavours with the officers to cauſe them buy their proviſions from him, and not from the king or his ſubjects. In this prince's territories, not far from the ſea, are the remains of a fort built by Avery the Pirate.

"All the women of Madagaſcar, excepting the very pooreſt ſort, wear a covering over their breaſts and ſhoulders, ornamented with glaſs beads, and none go without a cloth about their loins. They commonly walk with a long ſlender rod or ſtick. The men are allowed to marry as many women as they can ſupport.

"During our ſtay at this iſland (ſays Mr Ives), I obſerved, with great concern, ſeveral miſerable objects in the laſt ſtage of the venereal diſeaſe. They had not been able to find any cure; and as far as I could learn, their doctors are totally ignorant of medicine. The only method they uſe for curing all diſtempers, as well external as internal, is the wearing on the arm or neck a particular charm or amulet; or beſmearing the part affected with earth moiſtened with the juice of ſome plant or tree, and made up into a ſoft paſte.

"I took ſome pains to learn their religious tenets; and find that they worſhip one Univerſal Father; whom, when they ſpeak in Engliſh, they call *God*; and in whom they conceive all kinds of perfection to reſide. The ſun they look upon as a glorious body; and, I believe, as a ſpiritual being, but created and dependent. They frequently look up to it with wonder, if not with praiſe and adoration. They make their ſupplications to the *One* Almighty, and offer ſacrifices to him in their diſtreſſes. I had the curioſity to attend a ſacrifice, at the hut of John Anderſon, whoſe father had for a long time been afflicted with ſickneſs. About ſun-ſet an ox was brought into the yard; and the ſon, who officiated as prieſt, ſlew it. An altar was reared nigh, and the poſt of it was ſprinkled with the blood of the victim. The head, after its being ſevered from the the body, was placed, with the horns on, at the foot of the altar; the caul was burned on the fire, and moſt of the pluck and entrails boiled in a pot. The ſick man, who was brought to the door, and placed on the ground ſo as to face the ſacrifice, prayed often, and ſeemingly with great fervency. His eyes were fixed attentively towards the heavens, and his hands held up in a ſuplicating poſture. The ceremony ended with the ſon's cutting up the ox into ſmall pieces, the greateſt part of which he diſtributed among the poor ſlaves belonging to his father and himſelf; reſerving, however, ſome of the beſt pieces for his own uſe. Upon the whole, I ſaw ſo many circumſtances in the Madagaſcarian ſacrifice, ſo exactly reſembling thoſe deſcribed in the Old Teſtament as offered up by the Jews, that I could not turn my thoughts back to the original, without being ſenſibly ſtruck by the exactneſs of the copy."

When the ſquadron firſt arrived at Madagaſcar, the king of Baba, a man of about 60 years of age, was ill of the gout. Having demanded of admiral Watſon ſome preſents, the latter complimented him, among other things, with ſome brandy. The monarch then aſked him if he had any doctor with him, and if he was a great doctor, and a king's doctor? To all which being anſwered in the affirmative, he deſired him to bring ſome *Mahomets* (medicines) for his ſick knee. With this requiſition Mr Ives deſigned to comply; but having waited until ſome officers ſhould be ready to accompany him, his majeſty, in the mean time, took ſuch a doſe of brandy as quickly ſent the gout into his head, and occaſioned his death. Mr Ives obſerves, that it happened very luckily for him that the monarch's deceaſe happened without his having taken any of the medicines intended for him, as it would have been impoſſible to avoid the imputation of having poiſoned him, which would certainly have been reſented by his loyal ſubjects.

The king's death occaſioned great confuſion; the grandees being deſirous that it ſhould be concealed for ſome time. This, however, was found impoſſible; on which they ſet off for the *Mud Town* about 11 o'clock the ſame evening. All the inhabitants of the village followed their example; leaving only the dogs, who ſet up the moſt hideous howling. Captain Frederic Martin coming to take leave of the Engliſh, begged with great earneſtneſs for a freſh ſupply of gun-powder; whiſpering that the king was dead, and that they ſhould in all probability go to war about making another. They had been formerly told, that one who had the title of *duke* of Baba would certainly ſucceed to the throne; but they afterwards learned, that Philibey the general having eſpouſed the cauſe of *kaphani* the late king's ſon, and taken him under his tutelage and protection, this youth, who was only about 16 years of age, ſucceeded his father as king of Baba.

The following is a deſcriptions of the ſouthern diviſion of the iſland, from the Abbe Rochon.

"That part of Madagaſcar in which fort Dauphin is ſituated is very populous. Almoſt all the villages are placed on eminences, and ſurrounded with two rows of ſtrong palliſadoes, ſomewhat in the manner of ſuch of our fences as are compoſed of hurdles and turf. Within, is a parapet of ſolid earth about four feet in height;

height; large pointed bamboos placed at the diſtance of five feet from each other, and ſunk in a pit, form a kind of loop-holes, which contribute towards the defence of theſe villages, ſome of which are beſides fortified with a ditch ten feet in breadth and ſix in depth. The dwelling of the chief is called a *donac*. When the chiefs go abroad, they are alway provided with a muſket and a ſtick armed with iron, and adorned at the extremity with a little tuft of cow's hair. They wear a bonnet of red wool. It is chiefly by the colour of their bonnet that they are diſtinguiſhed from their ſubjects. Their authority is extremely limited: however, in the province of *Carcanoſſi*, the lands by cuſtom belong to their chiefs, who diſtribute them among their ſubjects for the purpoſes of cultivation; they exact a trifling quit-rent in return, which in their language is called *faenſa*.—The people of Carcanoſſi are not altogether ignorant of the art writing; they even poſſeſs ſome hiſtorical works in the Madagaſcar tongue: but their learned men, whom they term *Ombiaſſes*, make uſe of the Arabic characters alone. They have treatiſes on medicine, geomancy, and judicial aſtrology; the moſt renowned live in the province of *Matatane*: it is in that diſtrict that magic ſtill remains in all its glory; the Matanes are actually dreaded by the other Madecaſſees on account of their excellence in this deluſive art. The Ombiaſſes have public ſchools in which they teach geomancy and aſtrology. The natives have undoubtedly learned the art of writing from the Arabians, who made a conqueſt of this iſland about 300 years ſince.

"The people of the province of *Anoſſi*, near fort Dauphin, are lively, gay, ſenſible, and grateful; they are paſſionately fond of women; are never melancholy in their company; and their principal occupation is to pleaſe the ſex: indeed, whenever they meet their wives, they begin to ſing and dance. The women, from being happy, are always in good humour. Their lively and cheerful character is extremely pleaſing to the Europeans. I have often been preſent at their aſſemblies, where affairs of importance have been agitated; I have obſerved their dances, their ſports, and their amuſements, and I have found them free from thoſe exceſſes which are but too common among poliſhed nations. Indeed I was too young at this time for my obſervations to be of much weight: but if my experience be inſufficient to inſpire confidence, I beg the reader will rather conſider the nature of things, than the relations given by men without principles or intelligence, who fancy that they have a right to tyrannize over the inhabitants of every country which they can ſubdue. If the people of Madagaſcar have ſometimes availed themſelves of treachery, they have been forced to it by the tyranny of the Europeans. The weak have no other arms againſt the ſtrong. Could they defend themſelves by any other means from our artillery and bayonets? They are uninformed and helpleſs; and we avail ourſelves of their weakneſs, in order to make them ſubmit to our covetouſneſs and caprice. They receive the moſt cruel and oppreſſive treatment, in return for this hoſpitality which they generouſly beſtow on us; and we call them traitors and cowards, when we force them to break the yoke with which we have been pleaſed to load them."

In the ſecond volume of Count Benyowſky's Memoirs and travels, we have the following account of the religion, government, &c. of the people of this iſland.

"The Madagaſcar nation believe in a Supreme Being, whom they call *Zanhare*, which denotes creator of all things. They honour and revere this Being; but have dedicated no temple to him, and much leſs have they ſubſtituted idols. They make ſacrifices, by killing oxen and ſheep, and they addreſs all theſe libations to God. It has been aſſerted, that this nation likewiſe makes offerings to the devil: but in this there is a deception; for the piece of the ſacrificed beaſt which is uſually thrown into the fire is not intended in honour of the devil, as is uſually pretended. This cuſtom is very ancient, and no one can tell the true reaſon of it. With regard to the immortality of the ſoul, the Madagaſcar people are perſuaded, that, after their death, their ſpirit will return again to the region in which the Zanhare dwells; but they by no means admit that the ſpirit of man, after his death, can ſuffer any evil. As to the diſtinction of evil or good, they are perſuaded that the good and upright man ſhall be recompenſed, in this life, by a good ſtate of health, the conſtancy of his friends, the increaſe of his fortunes, the obedience of his children, and the happineſs of beholding the proſperity of his family: and they believe that the wicked man's fate ſhall be the contrary to this. The Madagaſcar people, upon this conviction, when they make oaths, add benedictions in favour of thoſe who keep them, and curſes againſt thoſe who break them. In this manner it is that they appeal to the judgment of Zanhare, in making agreements; and it has never been known, or heard of, that a native of Madagaſcar has broken his oath, provided it was made in the uſual manner, which they ſay was preſcribed by their forefathers.

"As to their kings and form of government, &c. The Madagaſcar people have always acknowledged the line of Ramini, as that to which the rights of Ampanſacabe or ſovereign belongs. They have conſidered this line as extinct ſince the death of Dian Ramini Larizon, which happened 66 years ago, and whoſe body was buried upon a mountain, out of which the river Manangourou ſprings; but having acknowledged the heir of this line on the female ſide, they re-eſtabliſhed this title in the year 1776. The right of the Ampanſacabe conſiſts in nominating the Rohandrians to aſſiſt in the cabars, at which all thoſe who are cited are bound to appear, and the judgment of the Ampanſacabe in his cabar is deciſive. Another prerogative of the Ampanſacabe is, that each Rohandrian is obliged to leave him by will a certain proportion of his property, which the ſucceſſors uſually purchaſe by a ſlight tribute or fine. Thirdly, the Ampanſacabe has a right to exact from each Rohandrian one tenth of the produce of his land, and a number of horned cattle and ſlaves, in proportion to the riches of the country poſſeſſed by each Rohandrian.—The ſecond order is compoſed of the Rohandrians, or princes. Since the loſs of the Ampanſacabe, three of theſe Rohandrians have aſſumed the title of *kings*, namely the Rohandrian of the province of Mahavelou, named *Hiavi*; of the province of Voemar, named *Lambouin*; and a third at Bombetoki, named *Cimanounpou*. The third order conſiſts of the Voadziri, or lords of a diſtrict, compoſed

compoſed of ſeveral villages. The fourth order conſiſts of the Lohavohits, or chiefs of villages. The fifth order, Odzatzi, who are freemen, and compoſe the attendants or followers of the Rohandrians, Voadziri, or Lohavohits. The ſixth order conſiſts of Ombiaſſes, or learned men; and this order forms the warriors, workmen, phyſicians, and diviners: theſe laſt poſſeſs no charge. The ſeventh order conſiſts of Ampurias or ſlaves.

"Having made inquiries from Bombetoki paſſing to the northward, and as far as Itapere, the reſult proved that there are 38 Rohandrians actually reigning, and 287 Voadziri. With reſpect to the Lohavohits, Ondzatzi, and Ombiaſſes, it was not poſſible to obtain any accurate determination of their number. Theſe orders preſerve a regular gradation, reſpecting which it would be very difficult to give a detailed account. They live in the manner we read of concerning the ancient patriarchs. Every father of a family is prieſt and judge in his own houſe, though he depends upon the Lohavohits, who ſuperintend his conduct. This laſt is anſwerable to his Voadziri, and the Voadziri to the Rohandrian.

"The Madagaſcar people having no communication with the main land of Ethiopia, have not altered their primitive laws; and the language throughout the whole extent of the iſland is the ſame. It would be a raſh attempt to determine the origin of this nation; it is certain that it conſiſts of three diſtinct races, who have for ages paſt formed intermixtures which vary to infinity. The firſt race is that of Zafe Ibrahim, or deſcendants of Abraham; but they have no veſtige of Judaiſm, except circumciſion, and ſome names, ſuch as Iſaac, Reuben, Jacob, &c. This race is of a brown colour.—The ſecond race is that of Zaferamini: with reſpect to this, ſome books which are ſtill extant among the Ombiaſſes, affirm, that it is not more than ſix centuries ſince their arrival at Madagaſcar.—With reſpect to the third race of Zafe Canambou, it is of Arabian extraction, and arrived much more lately than the others from the coaſts of Æthiopia: hence it poſſeſſes neither power nor credit, and fills only the charges of writers, hiſtorians, poets, &c.

"In regard to arts and trades, the Madagaſcar nation are contented with ſuch as are neceſſary to make their moveables, tools, utenſils, and arms for defence; to conſtruct their dwellings, and the boats which are neceſſary for their navigation; and laſtly, to fabricate cloths and ſtuffs for their cloathing. They are deſirous only of poſſeſſing the neceſſary ſupplies of immediate utility and convenience. The principal and moſt reſpected buſineſs, is the manufacture of iron and ſteel. The artiſts in this way calls themſelves *ampaneſa vihe*. They are very expert in fuſing the ore, and forging utenſils, ſuch as hatchets, hammers, anvils, knives, ſpades, ſagayes, razors, pincers, or tweezers for pulling out the hair, &c. The ſecond claſs conſiſts of the goldſmiths (*ompaneſa valamina*): they caſt gold in ingots and make up bracelets, buckles, ear-rings, drops, rings, &c. The third are called *ompavillanga*, and are potters. The fourth are the *ompanevatta*, or turners in wood, who make boxes called *vatta*, plates, wooden and horn ſpoons, bive-hives, coffins, &c. The fifth, *ompan cacaſou*, or carpenters. They are very expert in this buſineſs, and make uſe of the rule, the plane, the compaſſes, &c. The ſixth are the *ompanavi*, or rope-makers. They make their ropes of different kinds of bark of trees, and likewiſe of hemp. The ſeventh, *ampan lamba*, or weavers. This buſineſs is performed by women only, and it would be reckoned diſgraceful in a man to exerciſe it. The *ombiaſſes* are the literary men and phyſicians, who give advice only. The *herauvitz*, are comedians and dancers.

The Madagaſcar people always live in ſociety; that is to ſay, in towns and villages. The towns are ſurrounded by a ditch and palliſades (as already mentioned), at the extremities of which a guard from 12 to 20 armed men is kept. The houſes of private people conſiſt of a convenient cottage, ſurrounded by ſeveral ſmall ones: the maſter of the houſe dwells in the largeſt, and his women or ſlaves lodge in the ſmaller. Theſe houſes are built of wood, covered with leaves of the palm-tree or ſtraw.

"The houſes of the great men of the country are very ſpacious; each houſe is compoſed of two walls and four apartments: round about the principal houſe other ſmaller habitations are built for the accommodation of the women, and the whole family of the chief; but the ſlaves cannot paſs the night within them. Moſt of the houſes inhabited by the Rohandrians are built with taſte and admirable ſymmetry."

The French attempted to conquer and take poſſeſſion of the whole iſland, by order, and for the uſe of, their moſt Chriſtian Majeſties, Louis XIII. and XIV. and they maintained a footing on it from the year 1642 to 1657. During this period, by the moſt cruel treachery, they taught the native princes the barbarous traffic in ſlaves, by villainouſly ſelling to the Dutch governor of Mauritius a number of innocent people, who had been aſſiſting them in forming a ſettlement at Fort Dauphin.

The Abbe Rochon tells us, that the inſalubrity of the air in Madagaſcar determined his countrymen in 1664 to quit that immenſe iſland, in order to eſtabliſh themſelves at ſo inconſiderable a place as the Iſle of Bourbon, which is ſcarcely perceptible in a map of the globe: but it is apparent, from the account of the ſtate of the French affairs on the iſland of Madagaſcar in 1661, when Flacourt's narrative was publiſhed, that their ill treatment of the natives had raiſed ſuch a general and formidable oppoſition to their reſidence in the country, that the French were obliged to abandon their poſſeſſions for other reaſons than the unhealthy qualities of the climate. We have not room here for a detail of all the oppreſſive meaſures of the French, which the Abbe himſelf candidly cenſures in the ſtrongeſt terms; but ſhall extract the following narrative, both becauſe it is intereſting in itſelf, and exhibits the cauſes and the means of their expulſion.

La Caſe, one of the French officers employed by the governor of Fort Dauphin againſt the natives, was ſo ſucceſsful in all his enterpriſes, that they called him *Deaan Fous*, the name of a chief who had formerly conquered the whole iſland. The French governor, jealous of his renown, treated him harſhly, and refuſed to allow him the rank or honours due to his volour. The ſovereign of the province of Amboulle, called *Deaan Raſcitat*, taking advantage of his diſcontent, prevailed on him to become his general. Five Frenchmen followed him. Deaan Nong, the daughter of Raſcitat, captivated by the perſon and heroiſm of La Caſe, offered him her hand with the conſent of her father. The chief, grown old, infirm, and arrived at the laſt ſtage of exiſtence, had the ſatisfaction of ſecuring the happineſs of his ſubjects, by appointing his ſon-in-law abſolute maſter of the rich province of Amboulle. La Caſe, in marrying Deaan Nong, refuſed to take the titles and honours attached to the ſovereign power: he would accept of no other character, than that of the firſt ſubject of his wife, who was declared ſovereign at the death of her father. Secure in the affections of this princeſs, who was not only poſſeſſed of perſonal charms, but of courage and great qualities, he was beloved and reſpected by her family, and by all the people of Amboulle, who reverenced him as a father; and yet, how much ſoever he wiſhed it, he was unable to contribute to the proſperity of his countrymen at Fort Dauphin, whom he knew to be in the utmoſt diſtreſs. The governor, regarding him as a traitor, had ſet a price on his head, and on the heads of the five Frenchmen who had followed him. The neighbouring chiefs, irritated at this treatment of a man whom they ſo much venerated, unanimouſly refuſed to ſupply the fort with proviſions. This occaſioned a famine in the place, which, with a contagious fever and other maladies, reduced the French garriſon to 80 men.

The eſtabliſhment at Fort Dauphin, on the point of being totally deſtroyed, was preſerved for a ſhort time from ruin by the arrival of a veſſel from France, commanded by Kercadio an officer of Brittany, who, with the aſſiſtance of a young advocate who had been kidnapped on board the veſſel, prevailed on the envious and implacable governor Chamargou, to make peace with La Caſe and his ſovereign ſpouſe Deaan Nong. This peace, however, laſted but for a ſhort time; the French, reſtleſs and inſolent to the neighbouring nations, again drew on them the vengeance of the natives. Even the few friends whom they had been able to acquire by means of La Caſe, were rendered hoſtile to them by the tyrannic zeal of the miſſionaries; who, not contented with being tolerated and allowed to make converts, inſiſted on Deaan Manang, ſovereign of Mandrarey, a powerful, courageous, and intelligent chief, well diſpoſed to the French, to divorce all his wives but one. This prince, not convinced of the neceſſity of ſuch a meaſure, aſſured them that he was unable to change his habits and way of living, which were thoſe of his forefathers. "You would allow me (ſaid he) to have one wife; but if the poſſeſſion of one woman is a bleſſing, why ſhould a numerous ſeraglio be an evil, while peace and concord reign among thoſe of whom it is compoſed? Do you ſee among us any indications of jealouſy or hatred? No, all our women are good; all try to make me happy; and I am more their ſlave than their maſter." This ſpeech had no effect on father Stephen, ſuperior of the Madagaſcar miſſion. He peremptorily ordered him inſtantly to repudiate all his wives except one; and threatened, in preſence of the women, to have them taken from him by the French ſoldiers if he heſitated in complying with his commands. It is eaſy to imagine, ſays M. Rochon, with what indignation this language muſt have been heard in the *donac* or palace of this prince. The females aſſailed the miſſionary on all ſides; loaded him with execretions and blows; and, in their fury, would doubtleſs have afforded him no more quarter than the Thracian women did Orpheus, if Deaan Manang, notwithſtanding his own agitation, had not made uſe of all his authority to ſave him.

In order to free himſelf from the perſecution of this prieſt, he removed with his family 70 or 80 miles up into the country, but he was ſoon followed by Father Stephen and another miſſionary, with their attendants. The chief, Manang, ſtill received them civilly; but he intreated them no longer to inſiſt on the converſion of him and his people, as it was impoſſible to oblige them to quit the cuſtoms and manners of their anceſtors. The only reply which Father Stephen made to this intreaty, was by tearing off the *oli*, and the amulets and charms which the chief wore as ſacred badges of his own religion; and, throwing them into the fire, he declared war againſt him and his nation. This violence inſtantly coſt him and his followers their lives: they were all maſſacred by order of Manang, who vowed the deſtruction of all the French in the iſland; in which intention they proceeded in a manner that has been related by an eye-witneſs, who was afterwards provincial commiſſary of artillery, in a narrative publiſhed at Lyons in 1722, intitled *Voyage de Madagaſcar*. "Our yoke (ſays the abbé Rochon) was become odious and inſupportable. Hiſtorians, for the honour of civilized nations, ſhould bury in oblivion the afflicting narratives of the atrocities exerciſed on theſe people, whom we are pleaſed to call barbarous, treacherous, and deceitful, becauſe they have revolted againſt European adventurers, whoſe leaſt crime is that of violating the ſacred rights of hoſpitality."

It was about the year 1672 that the French were totally driven from the iſland of Madagaſcar; and no conſiderable attempts were made to form freſh eſtabliſhments there till within theſe few years, by M. de Modave, and by Count Benyowſki; neither of which was attended with ſucceſs, for reaſons given by the Abbe, but which we have not room to detail.

MADDER. See RUBIA.

M. Macquer obſerves, that the Hollanders are obliged to the refugees from Flanders for the knowledge of manufacturing the root of madder; and that they generally cultivate it in freſh lands which have not been ploughed. The commodity, when manufactured, is diſtinguiſhed into different kinds, as grape madder, bunch-madder, &c. The grape-madder is the heart of the root; the other, beſides the heart, conſiſts alſo of the bark and ſmall fibres proceeding from the principal root. For that kind called *grape-madder*, the fineſt roots are picked out, the bark ſeparated at the mill, and the inſide root kept moiſt in caſks for three or four years, which makes it more fit for dyeing than otherwiſe it would be. Unleſs madder be kept cloſe in this manner, it is apt to ſpoil, and loſes its bright colour in a great meaſure. It is yellow at firſt, but grows red and darker with age. It ſhould be choſen of a fine ſaffron colour, in very hard lumps, and of a ſtrong though not diſagreeable ſmell.

The madder uſed for dyeing cottons in the Eaſt-Indies, is in ſome reſpects different from that of Europe. On the coaſt of Coromandel it has the name of *chat*, and grows wild on the coaſt of Malabar. The cultivated kind is imported from Vaour and Tuccorin, but the moſt eſteemed is the Perſian chat called alſo *dumas*. Another plant, called *roye de chaye*, or colour-root, is alſo gathered on the coaſt of Coromandel; but this, though ſuppoſed to be a ſpecies of madder, is a kind of *galium flore albo*, which however, gives a tolerable good colour to cotton. Another ſpecies of madder, called *chive-boya*, and *chine-hazala*, is cultivated at Kunder in the neighbourhood of Smyrna, and ſome other countries of Turkey in Aſia. It is more eſteemed than the beſt Zealand madder imported into theſe parts by the Dutch; and experiments have ſhown that it is ſuperior to any other kind as a dyeing ingredient. The modern Greeks call this kind of madder *lizari*, and the Arabs *fonoy*. The fine colour of theſe madders, however, are by our author attributed to their being dried in the air, and not in ſtoves. Another kind of madder is produced in Canada, where it is called *tyſſa-voyana*; its qualities are nearly the ſame with the European kind.

The root of madder impregnates water with a dull red colour, and ſpirit of wine with a deep bright red. This root, when eat by animals along with their food, tinges their urine, and their moſt ſolid bones, of a deep red. Wool previouſly boiled in a ſolution of alum and tartar, receives from a hot decoction of madder and tartar a very durable but not a very beautiful red colour. Mr Margraaf (Berlin Mem. 1771), ſhows how a very durable lake of a fine red colour, fit for the purpoſes of painting, may be obtained from madder. This proceſs is as follows: Take two ounces of the pureſt Roman alum, and diſſolve it in three French quarts of diſtilled water that has boiled, and in a clean glazed pot. Set the pot on the fire; and when the water begins to boil, withdraw it, and add two ounces of the beſt Dutch madder. Boil the mixture once or twice; then remove it from the fire, and filter it through a double filter of paper not coloured. Let the liquor thus filtrated ſtand a night to ſettle, and pour off the clear liquor into the glazed pot previouſly well cleaned. Make the liquor hot, and add to it gradually a clear ſolution of ſalt of tartar in water, till all the madder is precipitated. Filtrate the mixture; and upon the red precipitate which remains upon the filter pour boiling diſtilled water, till the water no longer acquires a ſaline taſte. The red lake is then to be gently dried. No other water, neither rain or river water, produces ſo good a colour as that which has been diſtilled, and the quantity required of this is conſiderable. The colour of the above precipitate is deep; but if two parts of madder be uſed to one part of alum, the colour will be ſtill deeper: one part of madder and four parts of alum produces a beautiful roſe colour.

MADEIRAS, a cluſter of iſlands ſituated in the Atlantic ocean in W. Long. 16°, and between 32° and 33° N. Lat.—The largeſt of them, called *Madeira*, from which the reſt take their name, is about 55 Engliſh miles long, and 10 miles broad; and was firſt diſcovered on the 2d of July, in the year 1419, by Joao Gonzales Zarco, there being no hiſtorical foundation for the fabulous report of its diſcovery by one Machin an Engliſhman. It is divided into two capitanias, named *Funchal* and *Maxico*, from the towns of thoſe names. The former contains two judicatures, viz. Funchal and Calhetta; the latter being a town with the title of a county, belonging to the family of Caſtello Melhor. The ſecond capitania likewiſe comprehends two judicatures, viz. Maxico (read Maſhico) and San Vicente.

Funchal is the only cidade or city in this iſland, which has alſo ſeven villas or towns; of which there are four, Calhetta, Camara de Lobos, Ribeira Barba, and Ponta de Sol in the capitania of Funchal, which is divided into 26 pariſhes. The other three are in the capitania of Maxico, which conſiſts of 17 pariſhes; theſe towns are called *Maxico, San Ticente,* and *Santa Cruz*.

The governor is at the head of all the civil and military departments of this iſland, of Porto-Santo, the Salvages, and the Ilhas Deſartas; which laſt only contain the temporary huts of ſome fiſhermen, who reſort thither in purſuit of their buſineſs.

The law-department is under the corregidor, who is appointed by the king of Portugal, commonly ſent from Liſbon, and holds his place during the king's pleaſure. All cauſes come to him from inferior courts by appeal. Each judicature has a ſenate; and a *Juiz* or judge, whom they chooſe, preſides over them. At Funchal he is called *Juiz da Fora*; and in the abſence, or after the death of the corregidor, acts as his deputy. The foreign merchants elect their own judges, called the *Providor*, who is at the ſame time collector of the king's cuſtoms and revenues, which amount in all to about 12,000 l. Sterling. Far the greateſt part of this ſum is applied towards the ſalaries of civil and military officers, the pay of troops and the maintenance of public buildings. This revenue ariſes, firſt from the tenth of all the produce of this iſland belonging to the king, by virtue of his office as grand maſter of the order of Chriſt; ſecondly, from ten per cent. duties laid on all imports, proviſions excepted; and laſtly, from the eleven per cent. charged on all exports.

The iſland has but one company of regular ſoldiers of 100 men: the reſt of the military force is a militia conſiſting of 3000 men, divided into companies, each commanded by a captain, who has one lieutenant under him and one enſign. There is no pay given to either the private men or the officers of this militia: and yet their places are much ſought after, on account of the rank which they communicate. Theſe troops are embodied once a-year, and exerciſed once a month. All the military are commanded by the *Sergeante Mór* The governor has two *Capitanos de Sal* about him, who do duty as aides-de-camp.

The ſecular prieſts on the iſland are about 1200, many of whom are employed as private tutors. Since the expulſion of the Jeſuits, no regular public ſchool is to be found here; unleſs we except a ſeminary, where a prieſt, appointed for that purpoſe, inſtructs and educates ten ſtudents at the king's expence. Theſe wear a red cloak over the uſual black gowns worn by ordinary ſtudents. All thoſe who intend to go into orders, are obliged to qualify themſelves by ſtudying in the univerſity of Coimbra, lately re-eſtabliſhed in Portugal. There is alſo a dean and chapter at Madeira, with a biſhop at their head, whoſe income is conſiderably greater than the governor's; it conſiſts of 110 pipes of wine, and of 40 muys of wheat, each containing 24 buſhels; which amounts in common years to 3000 l. Sterling. Here are likewiſe 60 or 70 Franciſcan friars, in four monaſteries, one of which is at Funchal. About 300 nuns live on the iſland, in four convents, of the order of Merci, Sta, Clara, Incarnacao, and Dom Jeſus. Thoſe of the laſt mentioned inſtitution may marry whenever they chooſe, and leave their monaſtry.

In the year 1768, the inhabitants living in the 43 pariſhes of Madeira, amounted to 63,913, of whom there were 31,341 males and 32,572 females. But in that year 5243 perſons died, and no more than 2198 children were born; ſo that the number of the dead exceeded that of the born by 3045. It is highly probable that ſome epidemical diſtemper carried off ſo diſproportionate a number in that year, as the iſland would ſhortly be entirely depopulated if the mortality were always equal to this. Another circumſtance concurs to ſtrengthen this ſuppoſition, namely, the excellence of the climate. The weather is in general mild and temperate: in ſummer, the heat is very moderate on the higher parts of the iſland, whither the better ſort of people retire for that ſeaſon; and in the winter the ſnow remains there for ſeveral days, whilſt it is never known to continne above a day or two in the lower parts.

The common people of this iſland are of a tawny colour and well ſhaped; though they have large feet, owing perhaps to the efforts they are obliged to make in climbing the craggy paths of this mountainous country. Their faces are oblong, their eyes dark; their black hair naturally falls in ringlets, and begins to criſp in ſome individuals, which may perhaps be owing to intermarriages with negroes; in general, they are hard-featured, but not diſagreeable. Their women are too frequently ill-favoured; and want the florid complexion, which, when united to a pleaſing aſſemblage of regular features, gives our northern fair ones the ſuperiority over all their ſex. They are ſmall, have prominent cheek-bones, large feet, an ungraceful gait, and the colour of the darkeſt brunette. The juſt proportion of the body, the fine form of their hands, and their large, lively eyes, ſeem in ſome meaſure to compenſate for thoſe defects. The labouring men, in ſummer, wear linen trowſers, a coarſe ſhirt, a large hat, and boots; ſome have a ſhort jacket made of cloth, and a long cloak, which they ſometimes carry over their arm. The women wear a petticoat, and a ſhort corſelet or jacket, cloſely fitting their ſhapes, which is a ſimple, and often not an inelegant dreſs. They have alſo a ſhort, but wide cloak; and thoſe that are unmarried tie their hair on the crown of their head, on which they wear no covering.

The country people are exceedingly ſober and frugal; their diet in general conſiſting of bread and onions or other roots, and little animal-food. However, they avoid eating tripe, or any offals, becauſe it is proverbially ſaid of a very poor man, "He is reduced to eat tripe." Their common drink is water, or an infuſion of the remaining rind or ſkin of the grape (after it has paſſed through the wine-preſs), which when fermented acquires ſome tartneſs and acidity, but cannot be kept very long. The wine for which the iſland is ſo famous, and which their own hands prepare, ſeldom if ever regales them.

Their principal occupation is the planting and raiſing of vines; but as that branch of agriculture requires little attendance during the greateſt part of the year, they naturally incline to idleneſs. The warmth of the climate, which renders great proviſion againſt the inclemencies of weather unneceſſary, and the eaſe with which the cravings of appetite are ſatisfied, muſt tend to indolence, wherever the regulations of the legiſlature do not counteract it, by endeavouring, with the proſpect of increaſing happineſs, to infuſe the ſpirit of induſtry. It ſeems the Portugueſe government does not purſue the proper methods againſt this dangerous lethargy of the ſtate. They have lately ordered the plantation of olive trees here, on ſuch ſpots as are too dry and barren to bear vines; but they have not thought of giving temporary aſſiſtance to the labourers, and have offered no premium by which theſe might be induced to conquer their reluctance to innovations and averſion to labour.

The vineyards are held only on an annual tenure, and the farmer reaps but four-tenths of the produce, ſince four other tenths are paid in kind to the owner of the land, one tenth to the king, and one to the clergy. Such ſmall profits, joined to the thoughts of toiling merely for the advantage of others, if improvements were attempted, entirely preclude the hopes of a future increaſe. Oppreſſed as they are, they have however preſerved a high degree of cheerfulneſs and contentment; their labours are commonly alleviated with ſongs, and in the evening they aſſemble from different cottages to dance to the drowſy muſic of a guittar.

The inhabitants of the towns are more ill-favoured than the country-people, and often pale and lean. The men wear French clothes, commonly black, which do not ſeem to fit them, and have been in faſhion in the polite world about half a century ago. Their ladies are delicate, and have agreeable features: but the characteriſtic jealouſy of the men ſtill locks them up, and deprives them of a happineſs which the country-women, amidſt all their diſtreſſes, enjoy. Many of the better people are a ſort of *petite nobleſſe* which we would call *gentry*, whoſe genealogical pride makes them unſociable and ignorant, and cauſes a ridiculous affectation of gravity. The landed property is in the hands of a few ancient families, who live at Funchal, and in the various towns on the iſland.

Madeira conſiſts of one large mountain, whoſe branches riſe every-where from the ſea towards the centre of the iſland, converging to the ſummit, in the midſt of which is a depreſſion or excavation, called the *Val* by the inhabitants, always covered with a freſh and delicate herbage. The ſtones on the iſland ſeem to have been in the fire, are full of holes, and of a blackiſh colour; in ſhort the greater part of them are lava. A few of them are of the kind which the Derbyſhire miners call *dunſtone*. The ſoil of the whole iſland is a tarras mixed with ſome particles of clay, lime, and ſand, and has much the ſame appearance as ſome earths on the iſle of Aſcenſion. From this circumſtance, and from the excavation of the ſummit of the mountain, it is probable that in ſome remote period a volcano has produced the lava and the ochreous particles, and that the Val was formerly its crater.

Many brooks and ſmall rivulets deſcend from the ſummits in deep chaſms or glens, which ſeparate the various parts of the iſland. The beds of the brooks are in ſome places covered with ſtones of all ſizes, carried down from the higher parts by the violence of winter-rains or floods of melted ſnow. The water is conducted by wears and channels in the vineyards, where each proprietor has the uſe of it for a certain time; ſome being allowed to keep a conſtant ſupply of it, ſome to uſe it thrice, others twice, and others only once a-week. As the heat of the climate renders this ſupply of water to the vineyards abſolutely neceſſary, it is not without great expence that a new vineyard can be planted; for the maintenance of which, the owners muſt purchaſe water at a high price, from thoſe who are conſtantly ſupplied, and are thus enabled to ſpare ſome of it.

Wherever a level piece of ground can be contrived in the higher hills, the natives make plantations of eddoes, encloſed by a kind of dike to cauſe a ſtagnation, as that plant ſucceeds beſt in ſwampy ground. Its leaves ſerve as food for hogs, and the country-people uſe the roots for their own nouriſhment.

The ſweet potatoe is planted for the ſame purpoſe, and makes a principal article of diet; together with cheſnuts, which grow in extenſive woods, on the higher parts of the iſland, where the vine will not thrive. Wheat and barley are likewiſe ſown, eſpecially in ſpots where the vines are decaying through age, or where they are newly planted. But the crops do not produce above three months proviſions; and the inhabitants are therefore obliged to have recourſe to other food, beſides importing conſiderable quantities of corn from North America in exchange for wine. The want of manure, and the inactivity of the people, are in ſome meaſure the cauſes of this diſadvantage; but ſuppoſing huſbandry to be carried to its perfection here, they could not raiſe corn ſufficient for their conſumption. They make their threſhing-floors of a circular form, in a corner of a field, which is cleared and beaten ſolid for the purpoſe. The ſheaves are laid round about it; and a ſquare board, ſtuck full of ſharp flints below, is dragged over them by a pair of oxen, the driver getting on it to increaſe its weight. This machine cuts the ſtraw as if it had been chopped, and frees the grain from the huſk, from which it is afterwards ſeparated.

The great produce of Maderia is the wine, from which it has acquired fame and ſupport. Where the ſoil, expoſure, and ſupply of water, will admit of it, the vine is cultivated. One or more walks, about a yard or two wide, interſect each vineyard, and are included by ſtone-walls two feet high. Along theſe walks, which are arched over with laths about ſeven feet high, they erect wooden pillars at regular diſtances, to ſupport a lattice-work of bamboos, which ſlopes down from both ſides of the walk, till it is only a foot and a half or two feet high, in which elevation it extends over the whole vineyard. The vines are in this manner ſupported from the ground, and the people have room to root out the weeds which ſpring up between them. In the ſeaſon of the vintage, they creep under this lattice-work, cut off the grapes and lay them into baſkets: ſome bunches of theſe grapes weigh ſix pounds and upwards. This method of keeping the ground clean and moiſt, and ripening the grapes in the ſhade, contributes to give the Madeira wines that excellent flavour and body for which they are remarkable. The owners of vineyards are however obliged to allot a certain ſpot of ground for the growth of bamboos; for the lattice work cannot be made without them; and it is ſaid ſome vineyards lie quite neglected for want of this uſeful reed.

The wines are not all of equal goodneſs, and conſequently of different prices. The beſt, made of a vine imported from Candia by order of the Infante of Portugal, Don Henry, is called *Madeira Malmſey*, a pipe of which cannot be bought on the ſpot for leſs than 40 or 42 l. Sterling. It is an exceeding rich ſweet wine, and is only made in a ſmall quantity. The next ſort is a dry wine, ſuch as is exported for the London market, at 30 or 31 l. Sterling the pipe. Inferior ſorts for the Eaſt India, Weſt India, and North American markets, ſell at 28, 25, and 20 l. Sterling About 30,000 pipes, upon a mean, are made every year, each containing 110 gallons. About 13,000 pipes of the better ſorts are exported; and all the reſt is made into brandy for the Brazils, converted into vinegar, or conſumed at home.

The incloſures of the vineyards conſiſt of walls, and hedges of prickly pear, pomegranates, myrtles, brambles, and wild roſes. The gardens produce peaches, apricots, quinces, apples, pears, walnuts, cheſnuts, and many other European fruits; together with now and then ſome tropical plants, ſuch as bananas, goavas, and pine-apples.

All the common domeſtic animals of Europe are likewiſe found at Madeira; and their mutton and beef, though ſmall, is very well taſted. Their horſes are ſmall, but ſure-footed; and with great agility climb the difficult paths, which are the only means of communication in the country. They have no wheel-carriages of any kind; but in the town they uſe a ſort of drays or ſledges, formed of two pieces of plank joined by croſs pieces, which make an acute angle before; theſe are drawn by oxen, and are uſed to tranſport caſks of wine, and other heavy goods, to and from the warehouſes.

The animals of the feathered tribe, which live wild here, are more numerous than the wild quadrupeds; there being only the common grey rabit here, as a repreſentative of the laſt-mentioned claſs. Tame birds, ſuch as turkies, geeſe, ducks, and hens, are very rare, which is perhaps owing to the ſcarcity of corn.

There are no ſnakes whatſoever in Madeira; but all the houſes, vineyards, and gardens, ſwarm with lizards. The friars of one of the convents complained to Mr Forſter, that theſe vermin deſtroyed the fruit in their garden; they had therefore placed a braſs-kettle in the ground to catch them, as they are conſtantly running about in queſt of food. In this manner they daily caught hundreds, which could not get out on account of the ſmooth ſides of the kettle, but were forced to periſh.

The ſhores of Madeira, and of the neighbouring Salvages and Deſertas, are not without fiſh; but as they are not in plenty enough for the rigid obſervance of Lent, pickled herrings are brought from Gottenburg in Engliſh bottoms, and ſalted cod from New York and other American ports, to ſupply the deficiency.

MADIAN, (anc. geog.) a town of Arabia Petræa, near the Arnan; ſo called from one of the ſons of Abraham by Ketura, in ruins in Jerome's time. Jerome mentions another Madian, or Midian, beyond Arabia, in the deſart, to the ſouth of the Red Sea: and hence *Madianæi*, and *Madianitæi*, the people; and *Madianæa Regio*, the country.

MADNESS, a moſt dreadful kind of delirium, without fever. See (the *Index* ſubjoined to) Medicine.

MADOX (Dr Iſaac), an ingenious and worthy prelate, born of obſcure parents about the year 1696, who placed him apprentice to a paſtry-cook; but not reliſhing this employment, and having an inclination to learning, he was put to ſchool by ſome friends, and completed his ſtudies at Aberdeen. He entered into orders; and having the good fortune to be made chaplain to Dr Bradford biſhop of Chicheſter, he married his niece, a very ſenſible and worthy lady. From this time his preferment may be dated; he was made king's chaplain, clerk of the cloſet to queen Caroline, and about the year 1736 biſhop of St Aſaph; from whence, in 1743, he was tranſlated to Worceſter. He was an excellent preacher, and a great promoter of public charities; particularly the Worceſter infirmary, and the hoſpital for inoculating the ſmall-pox at London: his ſermon in favour of this latter inſtitution, preached in 1752, was much admired, and contributed greatly to extend the practice of inoculation. He publiſhed ſome other ſingle ſermons, and a Defence of the Doctrine and Diſcipline of the Church of England, in anſwer to Mr Neale's Hiſtory of the Puritans.—Dr Madox died in 1759.

MADRAS. See *St George*.

MADRE de Popa, a town and convent of South America, in Terra Firma, ſeated on the river Grande. It is almoſt as much reſorted to by pilgrims of America as Loretto is in Europe; and the image of the Virgin Mary is ſaid to have done many miracles in favour of the ſea-faring people. W. Lon. 76. 0. N. Lat. 11. 0.

MADREPORA, in natural hiſtory, the name of a genus of ſubmarine ſubſtances; the characters of which are, That they are almoſt of a ſtony hardneſs, reſembling the corals, and are uſually divided into branches, and pervious by many holes or cavities, which are frequently of a ſtellar figure.

In the Linnæan ſyſtem, this is a genus of lithophyta: The animal that inhabits it is the Meduſa; it comprehends 39 ſpecies. According to Donati, the madrepora is like the coral as to its hardneſs, which is equal to bone or marble; the colour is white when poliſhed; its ſurface is lightly wrinkled, and the wrinkles run lengthwiſe of the branches; in the centre there is a ſort of cylinder, which is often pierced thro' its whole length by two or three holes. From this cylinder are detached about 17 laminæ, which run to the circumference in ſtraight lines; and are tranverſely interſected by other laminæ, forming many irregular cavities; the cellules, which are compoſed of theſe laminæ ranged into a circle, are the habitations of little polypes, which are extremely tender animals, generally tranſparent, and variegated with beautiful colours. M. de Peyſſonel obſerves, that thoſe writers who only conſidered the figures of ſubmarine ſubſtances, denominated that claſs of them, which ſeemed pierced with holes, *pora*; and thoſe, the holes of which were large, they called *madrepora*. He defines them to be all thoſe marine bodies which are of a ſtony ſubſtance, without either bark or cruſt, and which have but one apparent opening at each extremity, furniſhed with rays that proceed from the centre to the circumference. He obſerves that the body of the animal of the madrepora, whoſe fleſh is ſo ſoft that it divides upon the gentleſt touch, fills the centre; the head is placed in the middle and ſurrounded by ſeveral feet or claws, which fill the intervals of the partitions obſerved in this ſubſtance, and are at pleaſure brought to its head, and are furniſhed with yellow papillæ. He diſcovered that its head or centre was lifted up occaſionally above the ſurface, and often contracted and dilated itſelf like the pupil of the eye: he ſaw all its claws moved, as well as its head or centre. When the animals of the madrepora are deſtroyed, its extremities become white. In the madrepora, he ſays, the animal occupies the extremity; and the ſubſtance is of a ſtony but more looſe texture than the coral. This is formed, like other ſubſtances of the ſame nature, of a liquor which the animal diſcharges; and he farther adds, that there are ſome ſpecies of the polype of the madrepora which are produced ſingly, and others in cluſters.

MADRID, a town of New Caſtile in Spain, and capital of the whole kingdom, though it never had the title of a *city*, is ſituated in W. Long. 3. 5. N. Lat. 40. 26. It ſtands in the centre of a large plain, ſurrounded with mountains, and in the very heart of Spain, on the banks of the little river Manzanares, which is always very low and ſhallow, except when it is ſwelled by the melting of the ſnow on the mountains. The city is in general well laid out; the ſtreets are very handſome; and the houſes are fair and lofty, but built of brick, with lattice-windows, excepting thoſe of the rich, who have glaſs in their windows; only, during the ſummer-heats, they uſe gauze, or ſome ſuch thin ſtuff, inſtead of it, to let in the freſh air. There are two ſtately bridges here over the Manzanares, a great many magnificent churches, convents, hoſpitals, and palaces. The royal palace, which ſtands on the weſt ſide of the town, on an eminence, is ſpacious and magnificent, conſiſting of three courts, and commanding a fine proſpect. At the eaſt end of the town is the prado, or pardo; which is a delightful plain, planted with regular rows of poplar trees, and watered with a great many fountains; where the nobility and gentry take the air on horſeback, or in their coaches, and the common people on foot, or divert themſelves with a variety of ſports and exerciſes. Almoſt all the ſtreets of Madrid are ſtraight, wide, clean, and well paved. The largeſt and moſt frequented are the ſtreet of Alcala, that of Atocha, that of Toledo, and the *Calle grande* or great ſtreet. Madrid has alſo ſeveral ſquares, which in general are not very regular. The principal are thoſe of San Joachim, Sol, Laſganitas, San Domingo, La Cevado, and the Plaza Mayor. The latter eſpecially deſerves notice for its ſpaciouſneſs and regularity, and the elegant and lofty houſes it contains. It is fifteen hundred and thirty-ſix feet in circuit. The houſes, of which there are 136, are of five ſtories, ornamented with balconies; the firſt of which ſupported by pillars, form a piazza round the ſquare, where the inhabitants may walk under cover. In the middle of the ſquare a market is kept.—The ſtreets and ſquares of Madrid, except the Plaza mayor which has been juſt deſcribed, are ornamented with fountains in a very ill taſte. Thoſe moſt to be diſtinguiſhed in this particular are the fountain of the ſmall irregular ſquare called *Plaza di Antonio Martin*, and that of the ſquare named *Puerta del Sol*. The others are not more magnificent though leſs ridiculous. The water of all theſe fountains is excellent; and the air of Madrid, though the weather be variable and uncertain, is extremely pure. It was this purity of the air and excellent quality of the water which induced Philip II. and his ſucceſſors to fix their reſidence in this city. It is alſo well ſupplied with proviſions of all kinds at reaſonable rates; and the court, with the reſort and reſidence of the quality, and high colleges and offices that are kept here, occaſion a briſk trade and circulation of money.

The ſacred edifices in this city have nothing remarkable in their architecture; thoſe of St Paſqual, St Iſabella, and the Carmelites, contain highly valuable collections of pictures which may be ſeen with admiration even after the paintings of the Eſcurial and the new palace. The church of St Iſidro, which heretofore belonged to the Jeſuits, has a portal which has eſcaped the contagion of the age in which it was built. There is another church much more modern, which on account of its maſs has a venerable appearance, but which true taſte may juſtly diſavow; it is that of St Saleſas, or the viſitation, founded by Ferdinand VI. and the queen Barbara his wife.—The convent of St Francis has already been ſome years building *, and there are hopes that it will become one of the fineſt productions of architecture in the capital.—Beſides a variety of charitable foundations, there are here three confraternities, the revenues of which are appropriated to the ſuccour of the wretched; and an inſtitution ſimilar to the *Mont de pieté* in Paris, the principal object of which is to advance money to the neceſſitous.

The city of Madrid contains 15 gates, 18 pariſhes, 35 convents of monks, and 31 of nuns; 39 colleges, hoſpitals, or houſes of charity; 7398 dwelling-houſes and about 140,000 inhabitants. The Lombard traveller, Father Caimo, tells us, that 50,000 ſheep and 12,000 oxen are annually conſumed there; to which his editor has added a ludicrous eſtimate of the onions and leeks devoured there, which he ſays amount to 970000000000000000000000000000045. But this writer (M. Bourgoanne obſerves) would not at preſent have any reaſon to complain of the diſagreeable ſmells of the ſtreets, nor would he find all the perfumes of Arabia neceſſary to defend himſelf from them. By the vigilance of the modern police, for which (M. Bourgoanne informs us) it is indebted to the count D'Aranda, it is rendered one of the cleaneſt cities in Europe.

There are four academies in Madrid: The firſt is the Spaniſh academy founded in 1714, in imitation of the French academy, and conſiſting of 24 members, including the preſident. Its device is a crucible on burning coals, with the motto *limpia, fixa, y da eſplendor*; "it purifies, fixes, and gives luſtre." Its firſt object was the compilation of a dictionary of the Spaniſh language, which was publiſhed in ſix volumes folio, and of which a new edition, with great additions, has been lately put to the preſs. The ſame accademy is alſo employed on a ſuperb edition of Don Quixotte, adorned with elegant engravings far ſuperior to the laſt, and collated with all the former editions. The ſecond is the academy of hiſtory; which owes its origin to a ſociety of individuals, the object of whoſe meetings was to preſerve and illuſtrate the hiſtorical monuments of the kingdom of Spain. Their labours met the approbation of Philip V. who in 1738 confirmed their ſtatutes by a royal cedula. This academy conſiſts of 24 members, including the preſident, ſecretary, and cenſor. Its device is a river at its ſource; and the motto, *In patriam populumque fluit*. The other two academies are the academy of the fine arts, painting, ſculpture, and architecture; and the academy of medicine. The latter is held in no great eſteem.

The environs of Madrid contain ſeveral royal ſeats; among which are El Buen Retiro, Caſa del Campo, Florida, Le Pardo, Sarſuela, and St Ildefonſo; but the moſt magnificent not only in this country but perhaps in the whole world is the Eſcurial, which takes its name from a ſmall village near which it ſtands, about 22 miles north-weſt from Madrid; and of which a deſcription is given under the article ESCURIAL. Another royal palace greatly admired particularly for its delicious gardens and ſurpriſing water-works, is Aranjuez, which is ſituated on the Tagus, about 30 miles ſouth of Madrid. See ARANJUEZ.

MADRIGAL, a ſhort amorous poem, compoſed of a number of free and unequal verſes, neither confined to the regularity of a ſonnet, nor to the point of an epigram; but only conſiſting of ſome tender and delicate thought, expreſſed with a beautiful, noble, and elegant ſimplicity.

Menage derives the word from *mandra*, which in Latin and Greek, ſignifies "a ſheep-fold;" imagining it to have been originally a kind of paſtoral or ſhepherd's ſong; whence the Italians formed their *madrigale*, and we *madrigal*. Others rather chooſe to derive it from the word *madrugar*, which in the Spaniſh language ſignifies "to riſe in the morning;" the *madrigales* being formerly ſung early in the morning by thoſe who had a mind to ſerenade their miſtreſſes.

MADURA, a province of of Aſia, in the peninſula on this ſide the Ganges; bounded on the eaſt by Tanjour and Marava, on the ſouth-eaſt by the ſea, on the weſt by the Balagate mountains, which ſeparate it from Malabar, and on the north by Viſapour and Carnate. The inhabitants are Gentoos, and of a thieviſh diſpoſition. The commodities are rice, elephants teeth, and cotton-cloth; of which laſt a great deal is made here, and very fine. The Dutch have a pearl-fiſhery, which brings them in a large ſum annually.

MÆANDER (anc. geog.), a celebrated river of Aſia Minor, riſing near Celænæ. It flows through Caria and Ionia into the Ægean ſea between Miletus and Priene, after it has been increaſed by the waters of the Marſyas, Lycus-Eudon, Lethæus, &c. It is cele-

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* Bourgoanne's Travels in Spain, 1789.

celebrated among the poets for its windings, which amount to not leſs than 600, and from which all obliquities have received the name of *mæanders*. It forms in its courſe, according to the obſervation of ſome travellers, the Greek letters ε ρ ξ ς & ω; and from its windings Dædalus is ſaid to have had the firſt idea of his famous labyrinth.

MÆATÆ, anciently a people of Britain, near Severus's wall, inhabiting the diſtrict now called *Lauderdale*, in Scotland.

MÆCENAS (Caius Cilnius), the great friend and counſellor of Auguſtus Cæſar, was himſelf a very polite ſcholar, but is chiefly memorable for having been the patron and protector of men of letters. He was deſcended from a moſt ancient and illuſtrious origin, even from the kings of Hetruria, as Horace often tells us; but his immediate forefathers were only of the equeſtrian order. He is ſuppoſed to have been born at Rome, becauſe his family lived there; but in what year, antiquity does not tell us. It ſays as little about his education; but we know it muſt have been of the moſt liberal kind, and perfectly agreeable to the dignity and ſplendor of his birth, ſince he excelled in every thing that related to arms, politics, and letters. How Mæcenas ſpent his younger years is alſo unknown to us, any farther than by effects; there being no mention made of him by any writer before the death of Julius Cæſar, which happened in the year of Rome 709. Then Octavius Cæſar, who was afterwards called *Auguſtus*, went to Rome, to take poſſeſſion of his uncle's inheritance; and then Mæcenas became firſt publicly known, though he appears to have been Auguſtus's intimate friend, and as it ſhould ſeem guardian, from his childhood. From that time he accompanied him through all his fortunes, and was his counſellor and adviſer upon all occaſions; ſo that Pedo Albinovanus juſtly called him *Cæſaris dextram*, "Cæſar's right-hand."

In A. R. 710, the year that Cicero was killed and Ovid born, Mæcenas diſtinguiſhed himſelf by his courage and military ſkill at the battle of Modena, where the conſuls Hirtius and Panſa were ſlain in fighting againſt Antony; as he did afterwards at Philippi. After this laſt battle began the memorable friendſhip between Mæcenas and Horace. Horace, as Suetonius relates, was a tribune in the army of Brutus and Caſſius, and upon the defeat of thoſe generals made a priſoner of war. Mæcenas, finding him an accompliſhed man, became immediately his friend and protector; and afterwards recommended him to Auguſtus, who reſtored to him his eſtate with no ſmall additions. In the mean time, though Mæcenas behaved himſelf well as a ſoldier in theſe and other battles, yet his principal province was that of a miniſter and counſellor. He was the adviſer, the manager, the negociator, in every thing that related to civil affairs. When the league was made at Brunduſium between Antony and Auguſtus, Mæcenas was ſent to act on the part of Auguſtus. This we learn from Horace in his journey to Brunduſium:

> *Huc venturus erat Mæcenas optimus, atque*
> *Cocceius, miſſi magnis de rebus uterque*
> *Legati, averſos ſoliti componere amicos.* Sat. v. l. 1.

And afterwards, when this league was near breaking, through the ſuſpicions of each party, Mæcenas was ſent to Antony to ratify it anew.

In the year 717, when Auguſtus and Agrippa went to Sicily to fight Sextus Pompeius by ſea, Mæcenas went with them, but ſoon after returned, to appeaſe ſome commotions which were riſing at Rome: for though he uſually attended Auguſtus in all his military expeditions, yet, whenever there was any thing to be done at Rome either with the ſenate or people, he was always diſpatched thither for that purpoſe.

Upon the total defeat of Antony at Actium, Mæcenas returned to Rome, to take the government into his hands, till Auguſtus could ſettle ſome neceſſary affairs in Greece and Aſia. Agrippa ſoon followed Mæcenas; and when Auguſtus arrived he placed theſe two great men and faithful adherents, the one over his civil the other over his military concerns. While Auguſtus was extinguiſhing the remains of the civil war in Aſia and Egypt, young Lepidus, the ſon of the triumvir, was forming a ſcheme to aſſaſſinate him at his return to Rome. This conſpiracy was diſcovered at once, by the extraordinary vigilance of Mæcenas; who, as Velleius Paterculus ſays, "obſerving the raſh councils of the headſtrong youth with the ſame tranquillity and calmneſs as if nothing at all had been doing, inſtantly put him to death, without the leaſt noiſe and tumult; and by that means extinguiſhed another civil war in its beginning."

The civil wars being now at an end, Auguſtus returned to Rome; and from this time Mæcenas indulged himſelf at vacant hours in literary amuſements, and the converſation of men of letters. In the year 734 Virgil died, and left Auguſtus and Mæcenas heirs to what he had. Mæcenas was exceſſively fond of this poet, who, of all the wits of the Auguſtan age, ſtood higheſt in his eſteem; and if the Georgics and the Æneid be owing to the good taſte and encouragement of this patron, as there is ſome reaſon to think, poſterity cannot commemorate him with too much gratitude. Horace may be ranked next to Virgil in Mæcenas's good graces; we have already mentioned how and at what time their friendſhip commenced. Propertius alſo acknowledges Mæcenas for his favourer and protector, lib. ii. eleg. 7. Nor muſt Varius be forgot, though we have nothing of his remaining; ſince we find him highly praiſed by both Virgil and Horace. He was a writer of tragedies; and Quintilian thinks he may be compared with any of the ancients. In a word, Mæcenas's houſe was a place of refuge and welcome to all the learned of his time; not only to Virgil, Horace, Propertius, and Varius, but to Fundarius, whom Horace extols as an admirable writer of comedies; to Fuſcus Ariſtius, a noble grammarian and Horace's intimate friend: to Plotius Mucca, who aſſiſted Varius in correcting the Æneid after the death of Virgil; to Valgius, a poet and very learned man, who, as Pliny tells us, dedicated a book to Auguſtus, *De uſu Herbarum*; to Aſinius Pollio, an excellent tragic writer; and to ſeveral others, whom it would be too tedious to mention. All theſe dedicated their works, or ſome part of them at at leaſt, to Mæcenas, and celebrated his praiſes in them over and over: and we may obſerve farther, what Plutarch tells us, that even Auguſtus himſelf inſcribed his Commentaries to him and to Agrippa.

Mæcenas continued in Auguſtus's favour to the end of his life, but not uninteruptedly. Auguſtus had an intrigue with Mæcenas's wife: and though the miniſter bore this liberty of his maſter very patiently, yet there was a coldneſs on the part of Auguſtus, which, however, ſoon went off. Mæcenas died in the year 745; but at what age we cannot preciſely determine, though we know he muſt have been old. He muſt have been older than Auguſtus, becauſe he was a kind of tutor to him in his youth: and we then find him often called *an old man* by Pædo Albinovanus, a cotemporary poet, whoſe elegy upon his dead patron is ſtill extant. He made Auguſtus his heir; and recommended his friend Horace to him in thoſe memorable laſt words, "*Horatii Flacci, ut mei, memor eſto*, &c." Horace, however, did not probably ſurvive him long, as there is no elegy of his upon Mæcenas extant, nor any account of one having ever been written, which there certainly would have been had Horace ſurvived him any time. Nay, Father Sanadon, the French editor of Horace, will have it, that the poet died before his patron; and that theſe laſt words were found only in Mæcenas's will, which had not been altered.

Mæcenas is ſaid never to have enjoyed a good ſtate of health in any part of his life: and many ſingularities are related of his bodily conſtitution. Thus Pliny tells us, that he was always in a fever; and that, for three years before his death, he had not a moment's ſleep. Though he was certainly an extraordinary man, and poſſeſſed many admirable virtues and qualities, yet it is agreed on all hands, that he was very luxurious and effeminate. "Mæcenas (ſays Vellius Parterculus) was of the equeſtrian order, but ſprung from a moſt illuſtrious origin. He was a man, who, when buſineſs required, was able to undergo any fatigue and watching; who conſulted properly upon all occaſions, and knew as well how to execute what he had conſulted; yet a man who in ſeaſons of leiſure was luxurious, ſoft, and effeminate, almoſt beyond a woman. He was no leſs dear to Cæſar than Agrippa, but diſtinguiſhed by him with fewer honours; for he always continued of the equeſtrian rank, in which he was born: not that he could not have been advanced upon the leaſt intimation, but he never ſolicited it."

But let moraliſts and politicians determine of Mæcenas as they pleaſe, the men of letters are under high obligations to celebrate his praiſes and revere his memory: for he countenanced, protected, and ſupported, as far as they wanted his ſupport, all the wits and learned men of his time; and that too, out of a pure and diſintereſted love of letters, when he had no little views of policy to ſerve by their means: whence it is no wonder, that all the protectors and patrons of learning, ever ſince, have uſually been called *Mæcenas's*.

MAELSTROM, a very dangerous whirlpool on the coaſt of Norway, in the 68th degree of latitude, in the province of Nordland, and the diſtrict of Lofoden, and near the iſland of Moſkoe, from whence it alſo takes the name of *Moſkoe ſtrom*. Its violence and roarings exceed that of a cataract, being heard to a great diſtance, and without any intermiſſion, except a quarter every ſixth hour, that is, at the turn of high and low water, when its impetuoſity ſeems at a ſtand, which ſhort interval is the only time the fiſhermen can venture in: but this motion ſoon returns, and, however calm the ſea may be, gradually increaſes with ſuch a draught and vortex as to abſorb whatever comes within their ſphere of action, and keep it under water for ſome hours, when the fragments, ſhivered by the rocks, appear again. This circumſtance, among others, makes ſtrongly againſt Kircher and others, who imagine that there is here an abyſs penetrating the globe, and iſſuing in ſome very remote parts, which Kircher is ſo particular as to aſſign, for he names the gulph of Bothnia. But after the moſt exact reſearches which the circumſtances will admit, this is but a conjecture without foundation; for this and three other vortices among the Ferroe iſlands, but ſmaller, have no other cauſe, than the colliſion of waves riſing and falling, at the flux and reflux, againſt a ridge of rocks and ſhelves, which confine the water ſo that it precipitates itſelf like a cataract; and thus the higher the flood riſes, the deeper muſt the fall be: and the natural reſult of this is a whirlpool or vortex, the prodigious ſuction whereof is ſufficiently known by leſſer experiments. But what has been thus abſorbed, remains no longer at the bottom than the ebb laſts; for the ſuction then ceaſes, and the flood removes all attraction, and permits whatever had been ſunk to make its appearance again. Of the ſituation of this amazing Moſkoeſtrom we have the following account from Mr Jonas Ramus, "The mountain of Helſeggen, in Lofoden, lies a league from the iſland Ver, and betwixt theſe two runs that large and dreadful ſtream called *Moſkoeſtrom*, from the iſland Moſkoe, which is in the middle of it, together with ſeveral circumjacent iſles, as Ambaaren, half a quarter of a league northward, Iſleſen, Hoeholm, Kieldhelm, Suarven, and Buckholm. Moſkoe lies about half a quarter of a mile ſouth of the iſland of Ver, and betwixt them theſe ſmall iſlands, Otterholm, Flimen, Sandfleſen, Stockholm. Betwixt Lofoden and Moſkoe, the depth of the water is between 36 and 40 fathoms; but on the other ſide, towards Ver, the depth decreaſes ſo as not to afford a convenient paſſage for a veſſel, without the riſk of ſplitting on the rocks, which happens even in the calmeſt weather: when it is flood, the ſtream runs up the country between Lofoden and Moſkoe with a boiſterous rapidity; but the roar of its impetuous ebb to the ſea is ſcarce equalled by the loudeſt and moſt dreadful cataracts; the noiſe being heard ſeveral leagues off, and the vortices or pits are of ſuch an extent and depth, that if a ſhip comes within its attraction, it is inevitably abſorbed and carried down to the bottom, and there beat to pieces againſt the rocks; and when the water relaxes, the fragments thereof are thrown up again. But theſe intervals of tranquillity are only at the turn of the ebb and flood, and calm weather: and laſt but a quarter of an hour, its violence gradually returning. When the ſtream is moſt boiſterous, and its fury heightened by a ſtorm, it is dangerous to come within a Norway mile of it; boats, ſhips, and yachts having been carried away, by not guarding againſt it before they were within its reach. It likewiſe happens frequently that whales come too near the ſtream, and are overpowered by its violence; and then it is impoſſible to deſcribe their howlings and bellowings in their fruitleſs ſtruggles to diſengage themſelves. A bear once attempting to ſwim from Lofoden to Moſkoe, with a deſign of preying upon the ſheep at paſture in the iſland, afforded the like ſpectacle to the people; the ſtream caught him, and bore him down, whilſt he roared terribly, ſo as to be heard on ſhore. Large ſtocks of firs and pine trees, after being abſorbed by the current, riſe again, broken and torn to ſuch a degree as if briſtles grew on them. This plainly ſhows the bottom to conſiſt of craggy rocks, among which they are whirled to and fro. This ſtream is regulated by the flux and reflux of the ſea; it being conſtantly high and low water every ſix hours. In the year 1645, early in the morning of Sexageſima Sunday, it raged with ſuch noiſe and impetuoſity, that on the iſland of Moſkoe, the very ſtones of the houſes fell to the ground."

MÆMACTERIA, ſacrifices offered to Jupiter at Athens in the winter month Mæmacterion. The god ſurnamed Mæmactes was intreated to ſend mild and temperate weather, as he preſided over the ſeaſons, and was the god of the air.

MÆMACTERION was the fourth month of the Athenian year, containing twenty-nine days, and anſwering to the latter part of our September, and the beginning of October. It received its name from the feſtival *Memacteria*, which was obſerved about this time. This month was called by the Bœotians *Alalcomenius*.

MÆNA, in ichthyology. See SPARUS.

MÆNALUS (anc. geog.) a mountain of Arcadia ſacred to the god Pan, and greatly frequented by ſhepherds. It received its name from Mænalus a ſon of Lycaon. It was covered with pine trees, whoſe echo and ſhade have been greatly celebrated by all the ancient poets.

MÆONIA, or MOEONIA, a country of Aſia Minor, and forming part of Lydia; namely, the neighbourhood of mount Tmolus, and the country watered by the Pactolus. The reſt on the ſea-coaſt was called Lydia. See LYDIA.

MÆONIDÆ, a name given to the Muſes, becauſe Homer, their greateſt and worthieſt favourite, was ſuppoſed to be a native of Mæonia.

MÆONIDES, a ſurname of Homer, becauſe, according to the opinion of ſome writers, he was born in Mæonia, or becauſe his father's name was Mæon.

MÆOTIS PALUS or LACUS, *Mæotica Palus*, or *Mæoticus Lacus*, (anc. geog.), a large lake or part of the ſea between Europe and Aſia, at the north of the Euxine; to which it communicates by the Cimerian Boſphorus. It was worſhipped as a deity by the Maſſagetæ. It extends about 390 miles from ſouth-weſt to north-eaſt, and is about 600 miles in circumference. Still called *Palus Mæotis*, reaching from Crim Tartary to the mouth of the Don.

MÆSTLIN (Michael), in Latin *Mæſtlinus*, a celebrated aſtronomer of Germany, was born in the duchy of Wittemberg; but ſpent his youth in Italy, where he made a ſpeech in favour of Copernicus's ſyſtem, which brought Galilæo over from Ariſtotle and Ptolemy, to whom he had been hitherto entirely devoted. He afterwards returned to Germany, and became profeſſor of mathematics at Tubingen; where, among his other ſcholars, he taught the great Kepler, who has praiſed ſeveral of his ingenious inventions, in his *Aſtronomia Optica*. Though Tycho Brahe did not aſſent to Mæſtlin's opinion, yet he allowed him to be an extraordinary perſon deeply ſkilled in the ſcience of aſtronomy. Mæſtlin publiſhed many mathematical and aſtronomical works; and died in 1590.

MÆSTRICHT, an ancient large, and ſtrong town of the Netherlands, ceded to the Dutch by the treaty of Munſter. The town-houſe and the other public buildings are handſome, and the palace is about four miles in circumference, and ſtrongly fortified. It is governed jointly by the Dutch and the biſhop of Liege; however, it has a Dutch garriſon. The inhabitants are noted for making excellent fire-arms, and ſome ſay that in the arſenal there are arms ſufficient for a whole army. Both Papiſts and Proteſtants are allowed the free exerciſe of their religion, and the magiſtrates are compoſed of both. It is ſeated on the river Maeſe, which ſeparates it from Wyck, and with which it communicates by a handſome bridge. Mæſtricht revolted from the Spaniards in 1570, but was reduced in 1579. Louis XIV. became maſter of it in 1673; but it was reſtored to the ſtates by the treaty of Nimeguen in 1678. E. Long. 5. 50. N. Lat. 51. 5.

MAFFÆUS (Vegio), a Latin poet, born in Lombardy in 1407, was greatly admired in his time. He wrote epigrams, and a humorous ſupplement to Virgil, which he called *The thirteenth book of the Æneid*: this was as humorouſly tranſlated into Engliſh a few years ſince by Mr Ellis. Maffæus wrote alſo ſome proſe works. He was chancellor of Rome towards the end of the pontificate of Martin V.; and died in 1458.

MAFFEI (Scipio), a celebrated Italian poet, born of an illuſtrious and ancient family at Verona, in 1675. After having finiſhed his ſtudies, he took arms, and diſtinguiſhed himſelf by his valour at the battle of Donawert; but he more particularly diſtinguiſhed himſelf by his love of learning, which made him undertake ſeveral voyages into France, England, and Germany. He converſed with the learned in all thoſe countries, and obtained their friendſhip and eſteem. He was a member of the academy of the Arcadia at Rome, an honorary foreign member of that of Inſcriptions at Paris; and died in 1755. He wrote many works in verſe and proſe, which are eſteemed; the moſt known of which are, 1. The tragedy of Merope, of which there are two French tranſlations in proſe. 2. Ceremony, a comedy. 3. A tranſlation, into Italian verſe, of the firſt book of Homer's Iliad. 4. Many other pieces of poetry, in a collection intitled *Rhyme and Proſe*, quarto. His principal works in proſe, are, 1. *Verona illuſtrata*. 2. *Iſtoria diplomatica*. 3. *Scienza cavallereſca*; an excellent work, in which he attacks duelling. 4. An edition of *Theatro Italiano*. 5. An edition of Caſſiodorus on the Epiſtles, Acts of the Apoſtles, and Apocalypſe. 6. *Galliæ antiquitates quædam ſelectæ atque in plures epiſtolas diſtributæ*; and ſeveral other works.

MAGADA, in mythology, a title under which Venus was known and worſhipped in Lower Saxony; where this goddeſs had a famous temple, which was treated with reſpect even by the Huns and Vandals when they ravaged the country. It is ſaid to have been deſtroyed by Charlemagne.

MAGADOXO, the capital town of a kingdom of the ſame name, in Africa, and on the coaſt of Ajan. It is ſeated near the mouth of a river of the ſame name, defended by a citadel, and has a good harbour. The inhabitants are Mahometans. E. Long. 45. 15. N. Lat 3. 0.

MAGAS, Magadis, (from μαγαδιζειν "to ſing or play in uniſon or octave,") the name of a muſical inſtrument in uſe among the ancients.

There were two kinds of *magades*, the one a ſtring inſtrument, formed of 20 chords arranged in pairs, and tuned to uniſon or octave, ſo that they yielded ten ſounds; the invention whereof is aſcribed by ſome to Sapho; by others, to the Lydians; and by ſome, to Timotheus and Miletus. The other was a kind of flute, which at the ſame time yielded very high and very low notes. The former kind was at leaſt much improved by Timotheus and Miletus, who is ſaid to have been impeached of a crime, becauſe by increaſing the number of chords he ſpoiled and diſcredited the ancient muſic.

MAGAZINE, a place in which ſtores are kept, of arms, ammunition, proviſions, &c. Every fortified town ought to be furniſhed with a large magazine, which ſhould contain ſtores of all kinds, ſufficient to enable the garriſon and inhabitants to hold out a long ſiege; and in which ſmiths, carpenters, wheel-wrights, &c. may be employed in making every thing belonging to the artillery; as carriages, waggons, &c.

Powder Magazine, is that place where the powder is kept in very large quantities. Authors differ greatly both with regard to the ſituation and conſtruction but all agree, that they ought to be arched and bomb-proof. In fortifications, they are frequently placed in the rampart; but of late they have been built in different parts of the town. The firſt powder-magazines were made with Gothic arches: but M. Vauban finding them too weak, conſtructed them in a ſemicircular form; whoſe dimenſions are 60 feet long within, 25 broad; the foundations are eight or nine feet thick, and eight feet high from the foundation to the ſpring of the arch; the floor is two feet from the ground, which keeps it from dampneſs.

An Engliſh engineer of great experience ſome time ſince had obſerved, that after the centres of ſemicircular arches are ſtruck, they ſettle at the crown and riſe up at the haunches, even with a ſtraight horizontal extrados, and ſtill much more ſo in powder-magazines, whoſe outſide at top is formed like the roof of a houſe, by two inclined planes joining in an angle over the top of the arch, to give a proper deſcent to the rain; which effects are exactly what might be expected agreeable to the true theory of arches. Now, as this ſhrinking of the arches muſt be attended with very ill conſequences, by breaking the texture of the cement after it has been in ſome degree dried, and alſo by opening the joints of the vouſſoirs at one end, ſo a remedy is provided for this inconvenience with regard to bridges, by the *arch of equilibration* in Mr Hutton's book on bridges; but as the ill effect is much greater in powder-magazines, the ſame ingenious gentleman propoſed to find an arch of equilibration for them alſo, and to conſtruct it when the ſpan is 20 feet, the pitch or height 10 (which are the ſame dimenſions as the ſemicircle), the inclining exterior walls at top forming an angle of 113 degrees, and the height of their angular point above the top of the arch equal to ſeven feet. This very curious queſtion was anſwered in 1775 by the reverend Mr Wildbore, to be found in Mr Hutton's *Miſcellanea Mathematica*

Artillery-Magazine. In a ſiege, the magazine is made about 25 or 30 yards behind the battery, towards the parallels, and at leaſt three feet under ground, to hold the powder, loaded ſhells, port fires, &c. Its ſides and roof muſt be well ſecured with boards to prevent the earth from falling in: a door is made to it, and a double trench or paſſage is ſunk from the magazine to the battery, one to go in and the the other to come out at, to prevent confuſion. Sometimes traverſes are made in the paſſages to prevent ricochet ſhot from plunging into them.

Magazine, on ſhip-board, a cloſe room or ſtorehouſe, built in the fore or afterpart of the hold, to contain the gun-powder uſed in battle. This apartment is ſtrongly ſecured againſt fire, and no perſon is allowed to enter it with a lamp or candle: it is therefore lighted, as occaſion requires, by means of the candles or lamps in the *light-room* contiguous to it.

Magazine Air-Gun. See *Air Gun.*

Magazines (Literary); a well known ſpecies of periodical publications, of which the firſt that appeared in England was *The Gentleman's*, ſet on foot by the inventor Mr Edward Cave in the year 1731: (See the article Cave). This, as Dr Kippis obſerves*, "may be conſidered as ſomething of an epocha in the literary hiſtory of this country. The periodical performances before that time were almoſt wholly confined to political tranſactions, and to foreign and domeſtic occurrences; but the monthly magazines have opened a way for every kind of inquiry and information. The intelligence and diſcuſſion contained in them are very extenſive and various; and they have been the means of diffuſing a general habit of reading through the nation, which in a certain degree hath enlarged the public underſtanding. Many young authors, who have afterwards riſen to conſiderable eminence in the literary world, have here made their firſt attempts in compoſition. Here too are preſerved a multitude of curious and uſeful hints, obſervations, and facts, which otherwiſe might have never appeared; or if they had appeared in a more evaneſcent form, would have incurred the danger of being loſt. If it were not an invidious taſk, the hiſtory of them would be no incurious or unentertaining ſubject. The magazines that unite utility with entertainment, are undoubtedly preferable to thoſe *(if there have been any ſuch)* which have only a view to idle and frivolous amuſement. It may be obſerved, that two of them, *The Gentleman's* and *The London*, which laſt was begun the year after the former, have amidſt their numerous rivals preſerved their reputation to the preſent day. They have both of them, in general, joined inſtruction with pleaſure; and this likewiſe hath been the caſe with ſome others of a later origin."—The original London Magazine, it is believed, has been diſcontinued for ſome years paſt.—The next oldeſt publication of this kind is that intitled *The Scots Magazine*; which was commenced at Edinburgh a few years poſterior to the appearance of the *Gentleman's* at London; which, like it, has ſurvived many rivals; and which ſtill ſubſiſts, deſervedly eſteemed for the chaſteneſs of its plan and the accuracy of its information.

MAGDALEN (Mary.) See Mary.

Religious of St Magdalen, a denomination given to divers communities of nuns, conſiſting generally of pe-

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* *Biog. Brit.* vol. iii. art. Cave.

nitent courtezans; ſometimes alſo called *Magdalanettes*. Such are thoſe at Metz, eſtabliſhed in 1452; thoſe at Paris, in 1492; thoſe at Naples, firſt eſtabliſhed in 1324, and endowed by Queen Sancha, to ſerve as a retreat for public courtezans, who ſhould betake themſelves to repentance; and thoſe of Rouen and Bourdeaux, which had their original among thoſe of Paris in 1618. In each of theſe monaſteries there are three kinds of perſons and congregations; the firſt conſiſt of thoſe who are admitted to make vows, and theſe bear the name of *St Magdalen*; the congregation of St Martha is the ſecond, and is compoſed of thoſe whom it is not judged proper to admit to vows; finally, the congregation of St Lazarus is compoſed of ſuch as are detained there by force.

The religious of St Magdalen at Rome were eſtabliſhed by Pope Leo X. Clement VIII. ſettled a revenue on them: and farther appointed, that the effects of all public proſtitutes, dying inteſtate, ſhould fall to them; and that the teſtaments of the reſt ſhould be invalid unleſs they bequeathed a portion of their effects, which was to be at leaſt a fifth part, to them.

MAGDALEN-Hoſpital. See LONDON, n° 115.

MAGDALENA, one of the Marqueſas iſlands, about five leagues in circuit, and ſuppoſed to be in S. Lat. 10. 25. W. Long. 138. 50. It was only ſeen at nine leagues diſtance by thoſe who diſcovered it.

MAGDALENE's CAVE, a cave of Germany, and in Carinthia, 10 miles eaſt of Grotz. It appears like a chaſm in a rock, and at the entrance torches are lighted to conduct travellers. It is divided into ſeveral apartments, or halls, with a vaſt number of pillars formed by nature, which give it a beautiful appearance; they being as white as ſnow, and almoſt tranſparent. The bottom is of the ſame ſubſtance, inſomuch that a perſon may fancy himſelf to be walking among the ruins of an enchanted caſtle, ſurrounded with magnificent pillars, ſome entire and others broken.

MAGDEBURG, a duchy of Germany, in the circle of Lower Saxony; bounded on the North by the duchy of Mecklenburgh, on the ſouth and ſouthweſt by the principality of Anhalt and Halberſtadt, on the eaſt by Upper Saxony with part of Brandenburg, and on the weſt by the duchy of Wolfenbuttle. The Saale circle, and that of Luxkenwalde, are ſeparated from the reſt, and ſurrounded on all ſides by a part of Upper Saxony. This country is, for the moſt part, level; but ſandy, marſhy, or overgrown with woods. There are ſalt ſprings in it ſo rich, that they are ſufficent to ſupply all Germany with that commodity. The Holz circle is the moſt fruitful part of it. In the Saale circle, where wood is ſcarce, there is pit-coal: and at Rothenburg is a copper-mine worked. The duchy is well-watered, for the Elbe paſſes through it; and the Saale, Havel, Aller, Ohre, and Elſter, either riſe in, or waſh ſome part of it in their courſe. The whole duchy, excluſive of that part of the county of Mansfeldt which is connected with it, is ſaid to contain 29 cities, ſix towns, about 430 villages, and 330,000 inhabitants. The ſtates of the country conſiſt of the clergy, the nobility and deputies of the cities. Before it became ſubject to the electoral houſe of Brandenburg, frequent diets were held in it; but at preſent no diets are held, nor have the ſtates the direction of the finances as formerly. Before the Reformation, it was an archbiſhopric, ſubject in ſpirituals to the Pope alone, and its prelate was primate of all Germany; but embracing the Reformation, it choſe itſelf adminiſtrators, till the treaty of Munſter in 1648, when it was given, together with the biſhopric of Halberſtadt, to the elector of Brandenburg, as an equivalent for the Hither Pomerania, granted by that treaty to the king of Sweden. Lutheraniſm is the predominant religion here; but Calviniſts, Jews, and Roman catholics, are tolerated. Of the laſt there are five convents, who never embraced the Reformation. All the Lutheran pariſhes, amounting to 314, are ſubject to 16 inſpectors, under one general ſuperintendant; only the clergy of the old town of Magdeburg are under the direction of their ſenior. The Jews have a ſynagogue at Halle. The manufactures of the duchy are cloth, ſtuffs, ſtockings, linen, oil-ſkins, leather, and parchment; of which, and grains of all ſorts, large quantities are exported. The arms of it are, Party per pale, ruby, and pearl. The king of Pruſſia, as duke of Magdeburg, ſits and votes between the elector of Bavaria, as duke of Bavaria, and the elector Palatine, as Palſgrave of Lautern. Of the ſtates of the circle of Lower Saxony he is the firſt. His matricular aſſeſſment for the duchy is 43 horſe and 196 foot, or 1300 florins monthly; and to the chamber of Witzlar 343 florins and 40 kruitzers. For the civil government of the duchy there is a council of regency, with a war and demeſne chamber; and for the eccleſiaſtical, a conſiſtory, and general ſuperintendant. The revenues of the duchy ariſing from the ſalt works, demeſnes and taxes, ſome of which are very heavy and oppreſſive, are ſaid to amount to 800,000 rixdollars annually. With reſpect to ſalt, every houſekeeper in the Pruſſian dominions is obliged to buy a certain quantity for himſelf and wife; and alſo for every child and ſervant, horſe, cow, calf, and ſheep, that he poſſeſſes. The principal places are Magdeburg, Halle, and Glauche.

MAGDEBURG, a city of Germany, in a duchy of the ſame name, of which it is not only the capital, but that of all Lower Saxony, and formerly even of all Germany. It ſtands on the Elbe in E. Long. 12. 2. N. Lat. 52. 16. It is a city of great trade, ſtrongly fortified, and very ancient. Its name ſignifies the *maiden city*; which, ſome imagine, took its riſe from the temple of Venus, which is ſaid to have ſtood here anciently, and to have been deſtroyed by Charlemagne. The founder of the city is ſuppoſed to have been Otho I or his empreſs Editha, daughter to Edmund the Saxon king of England. The ſame emperor founded a Benedictine convent here, which he afterwards converted into an archbiſhopric, of which the archbiſhop was a count-palatine, and had very great privileges, particularly that of wearing the archiepiſcopal pallium, and having the croſs borne before him, beſides many others. The firſt tournament in Germany is ſaid to have been appointed near this city, by the emperor Henry the Fowler; but theſe paſtimes were afterwards aboliſhed, becauſe they occaſioned ſuch envy and animoſity among the nobility, that ſeveral of them killed one another upon the ſpot.

ſpot. The ſituation of the city is very convenient and pleaſant, upon the banks of the Elbe, amidſt ſpacious fruitful plains, and on the road betwixt High and Low Germany. It has been a great ſufferer by fires and ſieges; but by none ſo much as that in 1631, when the emperor's general ,count Tilly, took it by ſtorm, plundered and ſet it on fire, by which it was entirely reduced to aſhes, except the cathedral, the convent of our Lady, and a few cottages belonging to fiſhermen; of 40,000 burghers, not above 400 eſcaping. The ſoldiers ſpared neither age nor ſex; but ripped up women with child, murdered ſucking infants in ſight of their parents, and raviſhed young women in the ſtreets; to prevent which violation, many of them flung themſelves into the Elbe, and others into the fire. The city is now populous, large, and well built, particularly the broad ſtreet and cathedral-ſquare. The principal buildings are the king's palace, the governor's houſe, the armoury, guild-hall, and cathedral. The laſt is a ſuperb ſtructure in the antique taſte, dedicated to St. Maurice, which has a fine organ, the maſter-pipe of which is ſo big, that a man can ſcarce claſp it with both arms; it alſo contains the tombs of the emperor Otho and the empreſs Editha; a fine marble ſtatue of St Maurice, a porphyry font, an altar in the choir of one ſtone of divers colours, curiouſly wrought, and many other curioſities. They ſhow here a bedſtead and table which belonged to Martin Luther, when he was an Auguſtine friar in a cloyſter of this city before the Reformation. Among the relicts, they pretend to have the baſon in which Pilate waſhed his hands after his condemnation of our Saviour; the lantern which Judas made uſe of when he apprehended him; and the ladder on which the cock crowed after St Peter denied him. The chapter conſiſts of a provoſt, 16 major and ſeven minor canons; beſides which, there are four other Lutheran collegiate foundations, and a Lutheran convent dedicated to our Lady, in which is a ſchool or ſeminary. Here is alſo a gymnaſium, with an academy, in which young gentlemen are inſtructed in the art of war. The canons of the chapter, which, except the change of religion, is upon the ſame footing as before the reformation, muſt make proof of their nobility. The prebends and dignities are all in the gift of the elector; and the revenue of the provoſt is computed at 12,000 crowns a-year. Here is a great trade, and a variety of manufactures. The chief are thoſe of woollen cloths, and ſtuffs, ſilks, cottons, linen, ſtockings, hats, gloves, tobacco and ſnuff. The city was formerly one of the Hanſe and imperial towns. Editha, conſort to Otho I. on whom it was conferred as a dowry, among many other privileges and advantages, procured it the grant of a yearly fair. The bargravate of this city was anciently an office of great power; having the civil and criminal juriſdiction, the office of hereditary cup-bearer being annexed to it; and was long held as a fief of the archbiſhopric, but afterwards became an imperial fief, which was again conferred on the archbiſhopric by the elector of Saxony, upon certain conditions.

MAGDOLUM, or MAGDALUM (anc. geog.), a town of the Lower Egypt, twelve miles to the ſouth of Peluſium (Herodotus, Antonine(, which doubtleſs is the Migdol or Magdol of Jeremiah.—Another MAGDALUM, or MIGDOL, denoting literally "a tower or place of ſtrength," near the Red Sea, (Moſes); far to the ſouth of the former.

MAGELLAN (Ferdinand), a celebrated Portugueſe mariner in the 16th century. He being diſſatisfied with the king of Portugal, went into the ſervice of the emperor Charles V. and ſailed from Seville with five veſſels in 1519, when he diſcovered and paſſed the ſtrait to which he gave his own name, and ſailed through the South Sea to the Ladrone Iſlands, when according to ſome authors, he was poiſoned in 1520; though others ſay that he was killed in a mutiny of his people in the iſland of Mutan, on account of his ſeverity. His voyage round the world was written by one on board, and has been frequently printed in Engliſh. His ſuddenly converting to the Chriſtian religion people whoſe language was unknown to him, as his was to them, is an abſurdity that diſcredits this work.

Straits of MAGELLAN, a narrow paſſage between the iſland of Terra del Fuego and the ſouthern extremity of the continent of America. This paſſage was firſt diſcovered by Ferdinand Magellan, who ſailed through it into the South Sea, and from thence to the Eaſt Indies. Other navigators have paſſed the ſame way; but as theſe ſtraits are exceedingly difficult, and ſubject to ſtorms, it has been common to ſail by Cape Horn, rather than through the ſtraits of Magellan. See *Straits Le Maire*, and *Terra del Fuego*.

MAGELLANIC-CLOUDS, whitiſh appearances like clouds, ſeen in the heaven towards the ſouth pole, and having the ſame apparent motion as the ſtars. They are three in number, two of them near each other. The largeſt lies far from the ſouth pole; but the other two are not many degrees more remote from it than the neareſt conſpicuous ſtar, that is, about 11 degrees. Mr Boyle conjectures, that if theſe clouds were ſeen through a good teleſcope, they would appear to be multitudes of ſmall ſtars, like the milky-way.

MAGGI (Jerome), in Latin *Magius*, one of the moſt learned men of the 16th century, was born at Anghiari in Tuſcany. He applied himſelf to all the ſciences, and even to the art of war: and diſtinguiſhed himſelf ſo much in this laſt ſtudy, that the Venetians ſent him into the Iſland of Cyprus in quality of judge of the admirality. When the turks beſieged Famaguſta, he performed all the ſervices that could be expected from the moſt excellent engineer: he invented mines and machines for throwing fire, by means of which he deſtroyed all the works of the beſiegers, and in an inſtant overthrew what had coſt the Turks infinite labour. But they had their revenge; for, taking the city in 1571, they plundered his library, carried him loaded with chains to Conſtantinople, and treated him in the moſt inhuman and barbarous manner. He nevertheleſs comforted himſelf from the example of Æſop, Menippus, Epictetus, and other learned men; and, after paſſing the whole day in the meaneſt drudgery, he ſpent the night in writing. He compoſed, by the help of his memory alone, treatiſes filled with quotations, which he dedicated to the Imperial and French ambaſſadors. Theſe miniſters, moved by compaſſion for this learned man, reſolved to purchaſe him: but while they were treating for his ranſom, Maggi found means to make his eſcape, and to get to the Imperial ambaſſador's houſe; when the Grand Vizir being enraged at his flight, and remembering the great miſchief he had done the Turks during the ſiege of Famaguſta, ſent to have him ſiezed, and cauſed him to be ſtrangled in priſon in 1572. His pricipal works are, 1. A treatiſe on the bells of the ancients. 2. On the deſtruction of the world by fire. 3. Commentaries on Æmilius Probus's lives of illuſtrious men. 4. Commentaries on the inſtitutes. Theſe works are written in elegant Latin. He alſo wrote a treatiſe on fortification in Italian; and a book on the ſituation of ancient Tuſcany.

He ought not to be confounded with his brother *Bartholomew Maggi*, a phyſician at Bologna, who wrote a treatiſe on gun-ſhot wounds; nor with *Vincent Maggi*, a native of Breſſe, and a celebrated profeſſor of humanity at Ferrare in Padua, who was the author of ſeveral works.

MAGGOT, the common name of the fly-worm bred in fleſh, from the egg of the great blue fleſh-fly. Notwithſtanding the diſtaſte for this animal, its figure and ſtructure of parts are greatly worth attending to; and may ſerve as a general hiſtory of the claſs of worms produced from the eggs of flies.

This animal is white and fleſhy: its body is compoſed of a number of rings, like the bodies of caterpillars and other ſimilar inſects; and is capable, at the pleaſure of the animal, of aſſuming different figures; being at times more or leſs extended in length, and conſequently more or leſs thick.

Notwithſtanding that this animal has no legs, it is able to move itſelf very ſwiftly; and in its firſt attempt to move its body, is extended to its greateſt length, and aſſumes ſomething of the figure of a pointed cone. The pointed part of the cone is the head of the animal, and is not ſeparated from the next ring by any deeper furrow than the reſt of the rings are from one another. In ſome ſtates of the animal, one may ſee two ſhort horns thruſt out from the head; but more generally two ſcaly hooks are obſervable: theſe are, however, ſometimes hid, and have each of them a caſe or ſheath; into which the animal can retract them at pleaſure. Theſe hooks are bent into an arch, the concavity of which is towards the plane on which the creature is placed; and they are thickeſt at their inſertion in the head, and thence diminiſh gradually, till they terminate in a fine ſharp point.

Theſe two hooks are placed in a parallel direction, and can never come together, and therefore cannot ſerve in the place of teeth for grinding the food; but merely to pull and ſever it in pieces, that it may be of a proper ſize for the mouth of the creature. Beſides theſe hooks the maggot has a kind of dart, which is about a third part of their length, and is placed at an equal diſtance between them. This alſo is brown and ſcaly like them; it is quite ſtraight, and terminates in a fine point. The hooks have as it were two ſcaly thorns at their points; and this dart ſeems intended, by reiterated ſtrokes, to divide and break the pieces of fleſh theſe have ſeparated from the reſt into ſmaller parts. Immediately below the apertures for the egreſs of the hooks, is placed the mouth of the animal; the creature does not ſhow this little opening unleſs preſſed: but if the preſſure is properly managed, it will ſufficiently open it, and there may be diſcovered within it a ſmall protuberance, which may very naturally be ſuppoſed either to be the tongue or the ſucker of the animal. The hooks in theſe creatures not only ſupply the place of teeth, but alſo of legs; ſince it is by faſtening theſe hooks into the ſubſtance it is placed on, and then drawing up its body to it, that it pulls itſelf along.

The back of this creature lowers itſelf by degrees as it approaches the extremity of the belly; and near the place where the back begins to lower itſelf, are placed the creature's two principal organs of reſpiration. One may perceive there two ſmall roundiſh brown ſpots: they are very eaſily diſtinguiſhable by the naked eye, becauſe the reſt of the body of the creature is white; but if we take in the aſſiſtance of glaſſes, each of theſe ſpots appears to be a brown circular eminence raiſed a little above the reſt of the body. On each of theſe ſpots one may alſo diſcover three oblong oval cavities, ſomething of the ſhape of button-holes; theſe are ſituated in a parallel direction to one another, and their length nearly in a perpendicular direction to that of the body of the animal. Theſe apertures are ſo many ſtigmata, or air-holes; openings deſtined to admit the air neceſſary to the life of the animal. It has ſix of theſe ſtigmata, three in each ſide of its body.

The great tranſparency of the body of this animal gives us an opportunity alſo to diſtinguiſh that it has on each ſide a large white veſſel running the whole length of the body. It is eaſy to follow the courſe of theſe veſſels through their whole length, but they are moſt diſtinct of all towards its hinder part; and they are always ſeen to terminate each in the brown ſpot abovementioned: this leaves us no room to doubt that they are the two principal tracheæ.

The ramifications of the two great tracheæ are very beautifully ſeen in this creature, eſpecially on its belly: and it is remarkable, that no veſſel analogous to the great artery in the caterpillar claſs can be diſcovered in theſe; though, if there were any ſuch, their great tranſparency muſt needs make them very eaſily diſtinguiſhable; nor could its dilatations and contractions, if ſo conſiderable as in that claſs of animals, be leſs ſo. See Eruca.

Malphighi imagined, that this artery in the caterpillar claſs was a ſeries of hearts; in its place, however, there may be ſeen in theſe animals a true heart. It is eaſy to obſerve in theſe creatures, about the fourth ring of their body, a ſmall fleſhy part which has alternate contractions and dilatations; and is not only diſcoverable in the body by means of its tranſparency, but on making a proper ſection of them in the ſecond, third, and fourth, will be thrown out of the body of the creature, and continue its beats for ſometime afterwards.

MAGI, or Magians, an ancient religious ſect in Perſia, and other eaſtern countries, who maintained that there were two principles, one the cauſe of all good, the other the cauſe of all evil: and, abominating the adoration of images, they worſhipped God only by fire; which they looked upon as the brighteſt and moſt glorious ſymbol of Oromaſdes, or the good God; as darkneſs is the trueſt ſymbol of Arimanius, or the evil god. This religion was reformed by Zoroaſter, who maintained that there was but one ſupreme independent Being; and under him two principles or angels, one the angel of goodneſs and light, and the other of evil and darkneſs: that there is a perpetual ſtruggle between them, which ſhall laſt to the end of the world; that then the angel of darkneſs and his diſciples ſhall go into a world of their own, where they ſhall be puniſhed in everlaſting darkneſs; and the angel of light and his diſciples ſhall alſo go into a world of their own, where they ſhall be rewarded in everlaſting light.

The prieſts of the magi were the moſt ſkilful mathematicians and philoſophers of the ages in which they lived, inſomuch that a learned man and magian became equivalent terms. The vulgar looked on their knowledge as ſupernatural; and hence thoſe who practiſed wicked and miſchievous arts, taking upon themſelves the name of *magians*, drew on it that ill ſignification which the word magician now bears among us.

This ſect ſtill ſubſiſts in Perſia under the denomination of *gaurs*, where they watch the ſacred fire with the greateſt care, and never ſuffer it to be extinguiſhed.

MAGIC, Magia, ΜΑΓΕΙΑ, in its ancient ſenſe, the ſcience or diſcipline and doctrine of the magi, or wiſe men of Perſia. See Magi.

The origin of magic and the magi is aſcribed to Zoroaſter. Salmaſius derives the very name from Zoroaſter, who, he ſays, was ſurnamed *Mog*, whence Magus. Others, inſtead of making him the author of the Perſian Philoſophy, make him only the reſtorer and improver thereof: alleging, that many of the Perſian rites in uſe among the magi were borrowed from the Zabii among the Chaldeans, who agreed in many things with the magi of the Perſians; whence ſome make the name *magus* common both to the Chaldeans and Perſians. Thus Plutarch mentions, that Zoroaſter inſtituted magi among the Chaldeans, in imitation whereof the Perſians had theirs too.

Magic, in a more modern ſenſe, is a ſcience which teaches to perform wonderful and ſurpriſing effects.

The word *magic* originally carried with it a very innocent, nay laudable meaning; being uſed purely to ſignify the ſtudy of wiſdom, and the more ſublime parts of knowledge; but in regard the ancient magi engaged themſelves in aſtrology, divination, ſorcery, &c. the term *magic* in time became odious, and was only uſed to ſignify an unlawful and diabolical kind of ſcience, depending on the aſſiſtance of the devil and departed ſouls.

If any wonder how ſo vain and deceitful a ſcience ſhould gain ſo much credit and authority over mens minds, Pliny gives the reaſon of it. It is, ſays he, becauſe it has poſſeſſed itſelf of three ſciences of the moſt eſteem among men; taking from each all that is great and marvellous in it. Nobody doubts but it had its firſt origin in medicine; and that it inſinuated itſelf into the minds of the people, under pretence of affording extraordinary remedies. To theſe fine promiſes it added every thing in religion that is pompous and ſplendid, and that appears calculated to blind and captivate mankind. Laſtly, it mingled judicial aſtrology with the reſt; perſuading people, curious of futurity, that it ſaw every thing to come in the heavens.

Agrippa divides magic into three kinds; natural, celeſtial, and ceremonial or ſuperſtitious.

Natural Magic is no more than the application of natural active cauſes to paſſive ſubjects; by means whereof many ſurpriſing, but yet natural effects are produced.

In this way many of our experiments in natural philoſophy, eſpecially thoſe of electricity, optics, and magnetiſm, have a kind of magical appearance, and among the ignorant and credulous might eaſily paſs for miracles. Such, without doubt, have been ſome of thoſe miracles wrought by ancient magicians, whoſe knowledge of the various powers of nature, there is reaſon to believe, was much greater than modern vanity will ſometimes allow †.

Baptiſta Porta has a treatiſe of natural magic, or of ſecrets for performing very extraordinary things by natural cauſes. The natural magic of the Chaldeans was nothing but the knowledge of the powers of ſimples and minerals. The magic which they called *theurgia*, conſiſted wholly in the knowledge of the ceremonies to be obſerved in the worſhip of the gods, in order to be acceptable. By virtue of theſe ceremonies they believed they could converſe with ſpiritual beings, and cure diſeaſes.

Celeſtial Magic, borders nearly on judicial aſtrology: it attributes to ſpirits a kind of rule or dominion over the planets, and to planets a dominion over men; and on thoſe principles builds a ridiculous kind of ſyſtem. See Astrology.

Superſtitious or Geotic Magic, conſiſts in the invocation of devils. Its effects are uſually evil and wicked, though very ſtrange, and ſeemingly ſurpaſſing the powers of nature; ſuppoſed to be produced by virtue of ſome compact, either tacit or expreſs, with evil ſpirits: but the truth is, theſe have not all the power that is uſually imagined, nor do they produce thoſe effects ordinarily aſcribed to them.

This ſpecies of magic, there is every reaſon to believe, had its origin in Egypt, the native country of paganiſm. The firſt magicians mentioned in hiſtory were Egyptians; and that people ſo famed for early wiſdom believed not only in the exiſtence of dæmons, the great agents in magic (ſee Dæmon), but alſo that different orders of thoſe ſpirits preſided over the elements of earth, air, fire, and water, as well as over the perſons and affairs of men. Hence they aſcribed every diſeaſe with which they were afflicted to the immediate agency of ſome evil dæmon. When any perſon was ſeized with a fever, for inſtance, they did not think it neceſſary to ſearch for any natural cauſe of the diſeaſe; it was immediately attributed to ſome dæmon which had taken poſſeſſion of the body of the patient, and which could not be ejected but by charms and incantations.

Theſe ſuperſtitious notions, which had ſpread from Egypt over all the eaſt, the Jews imbibed during their captivity in Babylon. Hence we find them in the writings of the new Teſtament attributing almoſt every diſeaſe to which they were incident to the immediate agency of devils (See Possession). Many of the ſame impious ſuperſtitions were brought from Egypt and Chaldea by Pythagoras, and tranſmitted by him and his followers to the Platoniſts in Greece. This

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† See *Stillingfleet's Origines Sacræ*, book ii. c. 2.

is apparent from the writers of the life of Pythagoras. Jamblicus, ſpeaking of the followers of that philoſopher, ſays expreſsly, that they cured certain diſeaſes by incantations; and Porphyry adds, that they cured diſeaſes both of the mind and of the body by ſongs and incantations. This was exactly the practice of the Egyptian prieſts, who were all ſuppoſed to keep up a conſtant intercourſe with dæmons, and to have the power of controuling them by magic charms and ſacred ſongs. Agreeably to this practice of his maſters, we are told that Pythagoras directed certain diſeaſes of the mind, doubtleſs thoſe which he attributed to the agency of dæmons, to be cured partly by *incantations*, partly by *magical hymns*, and partly by *muſic.*—*και τας ψυχας δε νοσουντας παρεμυθειτο τους μεν επωδαις και μαγειαις τους δε μουσικη.*

That there are different orders of created ſpirits,—whether called dæmons or angels,—whoſe powers intellectual and active greatly ſurpaſs the powers of man, reaſon makes probable, and revelation certain. Now it was the univerſal belief of the ancient nations, ſays the learned Moſheim†, and eſpecially of the orientals, that certain ſounds and words, for the moſt part barbarous, were highly grateful, and that others were equally diſagreeable, to theſe ſpirits. Hence, when they wiſhed to render a dæmon propitious, and to employ him on any particular office, the magicians compoſed their ſacred ſongs of the words which were believed to be agreeable to him; and when it was their intention to drive him from themſelves or others, they ſung in a ſtrain which they fancied a dæmon could not hear but with horror. From the ſame perſuaſion aroſe the cuſtom of ſuſpending from the neck of a ſick perſon, whoſe diſeaſe was ſuppoſed to be inflicted by a dæmon, an amulet, ſometimes made of gold and ſometimes of parchment, on which was written one or more of thoſe words which dæmons could not bear either to hear or to ſee: and in a didactic poem on the healing art ſtill extant, we are taught by *Serenus Sammonicus*, that the word ABRACADABRA is an infallible remedy for a ſemitertian fever or ague; and to baniſh grief of heart, *Marcellinus* thinks nothing more effectual than the word καριαγκων. In more modern times, as we are informed by Agrippa, the words uſed by thoſe in compact with the devil, to invoke him, and to ſucceed in what they undertake, are, *Dies, mies, jeſquet, benedoeſet, douvima, enitemaus.* There are an hundred other formulas of words compoſed at pleaſure, or gathered from ſeveral different languages, or patched from the Hebrew, or formed in imitation of it. And among the primitive Chriſtians there was a ſuperſtitious cuſtom, of which we ſuſpect ſome remains may yet be found among the illiterate vulgar in different countries, of faſtening to the neck of a ſick perſon, or to the bed on which he lay, ſome text from the New Teſtament, and eſpecially the firſt two or three verſes of the goſpel of St John, as a charm undoubtedly efficacious to baniſh the diſeaſe.

† See his edition of *Cudworth's Intellectual Syſtem.*

That magicians who could thus cure the ſick, were likewiſe believed to have the power of inflicting diſeaſes, and of working miracles, by means of their ſubſervient dæmons, need not be doubted. Ancient writers of good credit are full of the wonders which they performed. We ſhall mention a few of thoſe which are beſt atteſted, and inquire whether they might not have been effected by other means than the interpoſition of dæmons.

The firſt magicians of whom we read are thoſe who in Egypt oppoſed Moſes. And we are told, that when Aaron caſt down his rod, and it became a ſerpent, they alſo did the like with their inchantments; "for they caſt down every man his rod, and they became ſerpents." This was a phenomenon which, it muſt be confeſſed, had a very miraculous appearance; and yet there ſeems to have been nothing in it which might not have been effected by ſlight of hand. The Egyptians, and perhaps the inhabitants of every country where ſerpents abound, have the art of depriving them of their power to do miſchief, ſo that they may be handled without danger. It was eaſy for the magicians, who were favoured by the court, to pretend that they changed their rods into ſerpents, by dexterouſly ſubſtituting one of thoſe animals in place of the rod. In like manner they might pretend to change water into blood, and to produce frogs; for if Moſes gave in theſe inſtances, as we know he did in others, any previous information of the nature of the miracles which were to be wrought, the magicians might eaſily provide themſelves in a quantity of blood and number of frogs ſufficient to anſwer their purpoſe of deceiving the people. Beyond this, however, their power could not go. It ſtopped where that of all workers in legerdemain muſt have ſtopt—at the failure of proper materials to work with. Egypt abounds with ſerpents; blood could eaſily be procured; and without difficulty they might have frogs from the river: But when Moſes produced lice from the duſt of the ground, the magicians, who had it not in their power to collect a ſufficient quantity of theſe animals, were compelled to own this to be an effect of divine agency.

The appearance of Samuel to Saul at Endor is the next miracle ſeemingly performed by the power of magic, which we ſhall conſider. It was a common pretence of magicians, that they could raiſe up ghoſts from below, or make dead perſons appear unto them to declare future events; and the manner of their incantation is thus deſcribed by Horace:

—— Pallor utraſque
Fecerat horrendas aſpectu. Scalpere terram
Unguibus, et pullam divellere mordicus agnam
Cœperunt: cruor in foſſam confuſus, ut inde
Manes elicerent, animas reſponſa daturas.

"With yellings dire they fill'd the place,
And hideous pale was either's face.
Soon with their nails they ſcrap'd the ground,
And fill'd a magic trench profound
With a black lamb's thick ſtreaming gore,
Whoſe members with their teeth they tore;
That they might charm the ſprights to tell
Some curious anecdotes from hell."

FRANCIS.

Whether the witch of Endor made uſe of ſuch infernal charms as theſe, the ſacred hiſtorian has not informed us; but Saul addreſſed her, as if he believed that by ſome form of incantation ſhe could recal from the ſtate of departed ſpirits the ſoul of the prophet who had been for ſome time dead. In the ſubſequent apparition, however, which was produced, ſome have thought there was nothing more than a trick, by which a cunning woman impoſed upon Saul's credulity, making him believe that ſome confident of her own was the ghoſt of Samuel. But had that been the caſe, ſhe would undoubtedly have made the pretended Samuel's anſwer as pleaſing to the king as poſſible, both to ſave her own life, which appears from the context to have been in danger, and likewiſe to have procured the larger reward. She would never have told her ſovereign, ſhe durſt not have told him, that he himſelf ſhould be ſhortly ſlain, and his ſons with him; and that the hoſt of Iſrael ſhould be delivered into the hands of the Philiſtines. For this reaſon many critics, both Jewiſh and Chriſtian, have ſuppoſed that the apparition was really a dæmon or evil angel, by whoſe aſſiſtance the woman was accuſtomed to work wonders, and to foretel future events. But it is ſurely very incredible, that one of the apoſtate ſpirits of hell ſhould have upbraided Saul for applying to a *ſorcereſs*, or ſhould have accoſted him in ſuch words as theſe: "Why haſt thou diſquieted *me*, to bring me up? Wherefore doſt thou aſk of *me*, ſeeing the *Lord* is departed from thee, and is become thine enemy? For the *Lord* hath rent the kingdom out of thine hand, and given it to thy neighbour, even to David. Becauſe thou obeyedſt not the voice of the *Lord*, therefore the *Lord* hath done this thing to thee this day." It is to be obſerved farther, that what was here denounced againſt Saul was really prophetic, and that the event anſwered to the prophecy in every particular. Now, though we do not deny that there are created ſpirits of penetration vaſtly ſuperior to that of the moſt enlarged human underſtanding; yet we dare maintain, that no finite intelligence could by its own mere capacity have ever found out the preciſe time of the two armies engaging, the ſucceſs of the Philiſtines, the conſequences of the victory, and the very names of the perſons that were to fall in battle. Saul and his ſons were indeed men of tried bravery, and therefore likely to expoſe themſelves to the greateſt danger; but after the menaces which he received from the apparition, he would have been impelled, one ſhould think, by common prudence, either to chicane with the enemy, or to retire from the field without expoſing himſelf, his ſons, and the whole army, to certain and inevitable deſtruction; and his acting differently, with the conſequences of his conduct, were events which no limited underſtanding could either foreſee or certainly foretel. If to theſe circumſtances we add the ſuddenneſs of Samuel's appearance, with the effect which it had upon the ſorcereſs herſelf, we ſhall find reaſon to believe, that the apparition was that of no evil dæmon. There is not, we believe, upon record, another inſtance of any perſon's pretending to raiſe a ghoſt from below, without previouſly uſing ſome magical rites or ſome form of incantation. As nothing of that kind is mentioned in the caſe before us, it is probable that Samuel appeared before he was called. It is likewiſe evident from the narrative, that the apparition was not what the woman expected; for we are told, that "when ſhe ſaw Samuel, ſhe cried out for fear." And when the king exhorted her not to be afraid, and aſked what ſhe ſaw, "the woman ſaid, I ſee gods *(elohim)* aſcending out of the earth." Now, had ſhe been accuſtomed to do ſuch feats, and known that what ſhe ſaw was only her ſubſervient dæmon, it is not conceivable that ſhe could have been ſo frightened, or have miſtaken her familiar for *elohim* in any ſenſe in which that word can be taken. We are therefore ſtrongly inclined to adopt the opinion of thoſe who hold that it was Samuel himſelf who appeared and propheſied, not called up by the wretched woman or her dæmons, but, to her utter confuſion, and the diſgrace of her art, ſent by God to rebuke Saul's madneſs in a moſt affecting and mortifying way, and to deter all others from ever applying to magicians or dæmons for aſſiſtance when refuſed comfort from heaven. For though this hypotheſis may to a ſuperficial thinker ſeem to tranſgreſs the rule of Horace—*Nec deus interſit*, &c.—Which is as applicable to the interpretation of ſcripture, as to the introduction of ſupernatural agency in human compoſitions; yet he who has ſtudied the theocratical conſtitution of Iſrael, the nature of the office which was there termed regal, and by what means the adminiſtration was in emergencies conducted, will have a different opinion, and at once perceive the *dignus vindice nodus*.

The ſudden and wonderful deſtruction of the army of Brennus the Gaul, has likewiſe been attributed to magic, or, what in this inquiry amounts to the ſame thing, to the interpoſition of evil ſpirits, whom the prieſts of Apollo invoked as gods. Thoſe barbarians had made an inroad into Greece, and inveſted the temple of Apollo at Delphi, with a view to plunder it of the ſacred treaſure. Their numbers and courage overpowered all oppoſition; and they were juſt upon the point of making themſelves maſters of the place, when, Juſtin informs us, that, to encourage the beſieged, the prieſts and propheteſs "adveniſſe deum *clamant*; eumque ſe vidiſſe deſilientem in templum per culminis aperta faſtigia. Dum omnes opem dei ſuppliciter implorant, juvenem ſupra humanum modum inſignis pulchritudinis, comiteſque eiduas armatas virgines, ex propinques duabus Dianæ Minervæque ædibus occurriſſe, nec oculis tantum hæc ſe perſpexiſſe; audiſſe etiam ſtridorem arcus, ac ſtrepitum armorum: proinde ne cunctarentur, diis anteſignanis, hoſtem cædere et victoriæ deorum ſocios ſe adjungere," ſummis obſecrationibus monebant. Quibus vocibus incenſi, omnes certatim in prælium proſiliunt. Præſentiam Dei et ipſi ſtatim ſenſere: nam et terræ motu portio montis abrupta Gallorum ſtravit exercitum, et confertiſſimi cunei non ſine vulneribus hoſtium diſſipati ruebant. Inſecuta deinde tempeſtas eſt, quæ grandine et frigore ſaucios ex vulneribus abſumpſit (A]."

This was unqueſtionably an extraordinary event; and

(A) Called aloud that the god had arrived. That they had ſeen him leap into the temple through the aperture in the roof: That whilſt they were all humbly imploring his help, a youth of more than human beauty, accompanied by two virgins in armour, had run to their aſſiſtance from the neighbouring temples of Diana

and

and it muſt be aſcribed either to the immediate interpoſition of the ſupreme being, to natural means, or to the agency of dæmons: there is no other alternative. But it is altogether incredible that the Supreme Being ſhould have miraculouſly interpoſed to defend the temple of a pagan divinity. It is very difficult to ſuppoſe that an earthquake, produced in the ordinary courſe of nature, ſhould have been foretold by the prieſts, or that it could have happened ſo opportunely for the preſervation of their treaſure from the hands of fierce barbarians. Nothing, therefore, it has been ſaid, remains, but either to allow the earthquake to have been produced by evil ſpirits, or to deny the truth of the hiſtorian's relation. But the cataſtrophe of Brennus's army is recorded in the ſame manner by ſo many ancient writers of good credit, that we cannot call in queſtion their veracity: and therefore, being unwilling to admit the agency of dæmons into this affair, it will be incumbent on us to ſhow by what human contrivance it might have been effected; for its arrival at ſo critical a juncture will not eaſily ſuffer us to ſuppoſe it a mere *natural* event.

"The inclination of a Pagan prieſt (ſays Biſhop Warburton†) to aſſiſt his god in extremity, will hardly be queſtioned; and the inclination of thoſe at *Delphi* was not ill ſeconded by their public management and addreſs. On the firſt rumour of Brennus's march againſt them, they iſſued orders, as from the oracle, to all the region round, forbidding the country people to ſecret and bear away their wine and proviſions. The effects of this order ſucceeded to their expectations. The half-ſtarved barbarians finding, on their arrival in *Phocis*, ſo great a plenty of all things made ſhort marches, diſperſed themſelves over the country, and revelled in the abundance that was provided for them. This reſpite gave time to the friends and allies of the god to come to his aſſiſtance. Their advantages of ſituation likewiſe ſupported the meaſures which they had taken for a vigorous defence. The town and temple of Delphi were ſeated on a bare and cavernous rock, defended on all ſides with precipices inſtead of walls. A large receſs within aſſumed the form of a theatre; ſo that the ſhouts of ſoldiers, and the ſounds of military inſtruments, re-echoing from rock to rock, and from cavern to cavern, increaſed the clamour to an immenſe degree: which, as the hiſtorian obſerves, could not but have great effects on ignorant and barbarous minds. The playing off theſe panic terrors was not indeed of itſelf ſufficient to repulſe and diſſipate a hoſt of fierce and hungry invaders but it enabled the defenders to keep them at bay till a more ſolid entertainment was prepared for them in, the *exploſion* and fall of that portion of the rock at the foot of which the greater part of the army lay encamped.

† *Julian.*

"Among the caverns in the ſacred rock, there was one which, from an intoxicating quality diſcovered in the ſteam which iſſued from it, was rendered very famous by being fitted to recipient of the prieſteſs of Apollo (A). Now, if we only ſuppoſe this, or any other of the vapours emitted from the numerous fiſſures, to be endowed with that unctuous, or otherwiſe inflammatory quality, which modern experience ſhows to be common in mines and ſubterraneous places, we can eaſily conceive how the prieſts of the temple might, without the agency of Dæmons, be able to work the wonders which hiſtory ſpeaks of as effected in this tranſaction. For the throwing down a lighted torch or two into a chaſm whence ſuch a vapour iſſued, would ſet the whole into a flame; which, by ſuddenly rarifying and dilating the air, would, like fired gun-powder, blow up all before it. That the prieſts, the guardians of the rock, could be long ignorant of ſuch a quality, or that they would divulge it when diſcovered, cannot be ſuppoſed. Strabo relates, that one *Onomarchus*, with his companions, as they were attempting by night to dig their way through to rob the holy treaſury, were frightened from their work by the violent ſhaking of the rock; and he adds, that the ſame phenomenon had defeated many other attempts of the like nature. Now, whether the tapers which *Onomarchus* and his companions were obliged to uſe while they were at work, inflamed the vapour, or whether the prieſts of Apollo heard them at it, and ſet fire to a countermine, it is certain a quality of this kind would always ſtand them in ſtead. Such then (preſumes the learned prelate) was the expedient (B) they employed to diſlodge this neſt of hornets, which had ſettled at the foot of their ſacred rock; for the ſtorm of thunder, lightening, and hail, which followed, was the natural effect of the violent concuſſions given to the air by the exploſion of the mine."

Two inſtances more of the power of ancient magic we ſhall juſt mention, not becauſe there is any thing

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and Minerva; and that they had not only beheld theſe things with their eyes, but had alſo heard the whizzing of his bow and the clangor of his arms. They therefore earneſtly exhorted the beſieged not to neglect the heavenly ſignal, but to ſally out upon their enemies, and partake with the divinities of the glory of the victory." With theſe words the ſoldiers being animated, eagerly ruſhed to battle: and were themſelves quickly ſenſible of the preſence of the god; for part of the rock being torn away by an earthquake, rolled down upon the Gauls; whoſe thickeſt battalions being thus thrown into confuſion, fled, expoſed to the weapons of their enemies. Soon afterwards a tempeſt aroſe, which by cold and fall of hailſtones cut off the wounded.

(A) "In hoc rupis anfractu, media ferme montis altitudine, planities exigua eſt, atque in ea profundum terræ foramen, quod in oraculo patet, ex quo frigidus ſpiritus, vi quadam velut vento in ſublime expulſus, mentes vatum in vecordiam vertit, impletaſque deo reſponſa conſulentibus dare cogit." JUST. lib. 24. c. 10.

(B) The learned author, by arguments too tedious to be here enumerated, confirms the reaſoning which we have borrowed from him; and likewiſe from hiſtory, that the prieſts, before they came to extremities with the ſacred rock, had entered into treaty with thoſe barbarians, and paid them a large tribute to decamp and quit the country. This adds greatly to the probability of his account of the exploſion; for nothing but the abſolute impoſſibility of getting quit of their beſiegers by any other means, could have induced the prieſts to hazard an experiment ſo big with danger to themſelves as well as to their enemies.

thing particular or important in the facts, but becauſe ſome credit ſeems to have been given to the narration by the diſcerning Cudworth. Philoſtratus, in his life of Apollonius Tyanæus, informs us, that a *laughing Dæmoniac* at Athens was cured by that magician, who ejected the evil ſpirit by threats and menaces; and the biographer adds, that the dæmon, at his departure, is ſaid to have overturned a ſtatue which ſtood before the porch where the cure was performed. The other inſtance is of the ſame magician freeing the city of Epheſus from the *plague* by ſtoning to death an old ragged beggar whom Apollonius called the *plague*, and who appeared to be a *dæmon* by his changing himſelf into the form of a *ſhagged dog*.

That ſuch tales as theſe ſhould have been thought worthy of the ſlighteſt notice by the incomparable author of the Intellectual Syſtem, is indeed a wonderful phænomenon in the hiſtory of human nature. The whole ſtory of Apollonius Tyanæus, as is now well known, is nothing better than a collection of the moſt extravagant fables[‡]: but were the narrative ſuch as that credit would be given to the facts here related, there appears no neceſſity in either caſe for calling in the agency of evil ſpirits by the power of magic.— The Athenians of that age were a ſuperſtitious people. Apollonius was a ſhrewd impoſtor, long practiſed in the art of deceiving the multitude. For ſuch a man it was eaſy to perſuade a friend and confident to act the part of the *laughing dæmoniac*; and without much difficulty the ſtatue might be ſo undermined as inevitably to tumble upon a violent concuſſion being given to the ground at the time of the departure of the pretended dæmon. If ſo, this feat of magic dwindles down into a very trifling trick performed by means both ſimple and natural. The other caſe of the poor man at Epheſus, who was ſtoned to death, is exactly ſimilar to that of thoſe innocent women in our own country, whom the vulgar in the laſt century were inſtigated to burn for the ſuppoſed crime of witchcraft. We have no reaſon to ſuppoſe that an Epheſian mob was leſs inflammable or credulous than any other mob, or that Apollonius played his part with leſs ſkill than a Chriſtian dæmonologiſt: and as the ſpirits of our witches, who were ſacrificed to folly and fanaticiſm, were often ſuppoſed to migrate from their dead bodies into the bodies of *hares* or *cats* accidentally paſſing by, ſo might this impoſtor at Epheſus perſuade his cruel and credulous inſtruments, that the ſpirit of their victim had taken poſſeſſion of the body of the *ſhagged dog*.

Still it may be ſaid, that in *magic* and *divination* events have been produced out of the ordinary courſe of nature; and as we cannot ſuppoſe the Supreme Being to have countenanced ſuch abominable practices by the interpoſition of his power, we muſt neceſſarily attribute thoſe effects to the agency of dæmons, or evil ſpirits. Thus, when Æneas conſulted the Sybil, the agency of the inſpiring god changed her whole appearance:

——————" Poſcere fata
Tempus," ait: " Deus, ecce, Deus." Cui talia fanti
Ante fores, ſubito non vultus, non color unus,
Non comptæ manſere comæ: ſed pectus anhelum,
Et rabie fera corda tument; majorque videri,
Nec mortale ſonans; afflata eſt numine quando
Jam propiore Dei.——— ——
——————" Aloud ſhe cries,
" This is the time, inquire your deſtinies.
He comes, behold, a god!" Thus while ſhe ſaid,
And ſhivering at the ſacred entry ſtaid,
Her colour chang'd, her face was not the ſame,
And hollow groans from her deep ſpirit came:
Her hair ſtood up; convulſive rage poſſeſs'd
Her trembling limbs, and heav'd her lab'ring breaſt;
Greater than human kind ſhe ſeem'd to look,
And with an accent more than mortal ſpoke.
Her ſtaring eyes with ſparkling fury roll,
When all the god came ruſhing on her ſoul."

DRYDEN.

In anſwer to this, it is to be obſerved, that the temple of Apollo at Cumæ was an immenſe excavation in a ſolid rock. The rock was probably of the ſame kind with that on which the temple of Delphi was built, full of fiſſures, out of which exhaled perpetually a poiſonous kind of vapour. Over one of theſe fiſſures was the tripod placed, from which the prieſteſs gave the oracle. Now we learn from St Chryſoſtom, that the prieſteſs was a woman; " Quæ in tripodes ſedens expanſa malignum ſpiritum per interna immiſſum, et per genitales partes ſubeuntem excipiens, furore repleretur, ipſaque reſolutis crinibus baccharetur, ex ore ſpumam emittens, et ſic furoris verba loquebatur." By comparing this account with that quoted above from Juſtin, which is confirmed both by Pauſanias and by Strabo, it is evident, that what Chryſoſtom calls *malignum ſpiritum* was a particular kind of vapour blown forcibly through the fiſſure of the rock. But if there be a vapour of ſuch a quality as, if received *per partes genitales*, would make a woman furious, there is ſurely no neceſſity for calling into this ſcene at Cumæ the agency of a dæmon or evil ſpirit. Beſides, it is to be remembered, that in myſtical and magical rites, ſuch as this was, both the prieſts, and the perſons conſulting them prepared themſelves by particular kinds of food, and ſometimes, as there is reaſon to believe, by human ſacrifices[‡], for the approach of the god or dæmon whoſe aid they invoked. On the preſent occaſion, we know from the poet himſelf, that a cake was uſed which was compoſed of poppy-ſeed and honey; and Plutarch ſpeaks of a ſhrub called *leucophyllus*, uſed in the celebration of the myſteries of Hecate, which drives men into a kind of frenzy, and makes them confeſs all the wickedneſs which they had done or intended. This being the caſe, the illuſions of fancy occaſioned by poppy will ſufficiently account for the change of the ſybil's appearance, even though the inhaled vapour ſhould not have poſſeſſed that efficacy which Chryſoſtom and Juſtin attribute to it. Even ſome ſorts of our ordinary food occaſion ſtrange dreams, for which onions in particular are remarkable. Exceſſive drunkenneſs, as is well known, produces a diſorder named by the bacchanalians of Europe *the blue devils*, which conſiſts of an immenſe ſucceſſion of ſpectres, accompanied with extreme horror to the perſon who ſees them. From theſe facts, which cannot be denied, there muſt ariſe a ſuſpicion, that by uſing very unnatural food, ſuch as human blood, the vileſt of inſects,

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[‡] See *Prideaux's Connections*, *Brucker's Hiſtory of Philoſophy*, and *Moſheim's Notes on Cudworth's Intellectual Syſtem*.

[‡] Vide *Lucani Pharſalia*, lib. 6. et *Arnob. C. Gentes*, lib. 1.

ſerpents, and medicated cakes, by ſhutting themſelves up in ſolitudes and caves, and by deviſing every method to excite horrid and dreadful ideas or images in the fancy, the ancient magicians might by natural means produce every phenomenon which they attributed to their gods or dæmons. Add to this, that in ancient times magic was ſtudied as a ſcience. Now, as we cannot ſuppoſe that every one who ſtudied it intended abſolutely nothing, or that all who believed in it were *wholly* deceived; what can we infer, but that the ſcience conſiſted in the knowledge of thoſe drugs which produced the phantoms in the imagination, and of the method of preparing and properly employing them for that purpoſe? The celebrated Friar Bacon indeed, as far back as the 13th century, wrote a book *de Nullitate Magiæ:* but though we ſhould allow that this book proved to demonſtration, that in his time no ſuch thing as magic exiſted, it never could prove that the caſe had always been ſo. At that time almoſt all the ſciences were loſt; and why not magic as well as others? It is likewiſe an undoubted fact, that magic at all times prevailed among the Aſiatics and Africans more than among the Europeans. The reaſon doubtleſs was, that the former had the requiſites for the art in much greater perfection than we. Human ſacrifices were frequent among them; they had the moſt poiſonous ſerpents, and the greateſt variety of vegetable poiſons, together with that powerful narcotic opium; all which were of eſſential uſe in myſtical and magic rites. They had, beſides, a burning ſun, frightful deſarts and ſolitudes; which, together with extreme faſting, were all called into their aſſiſtance, and were ſufficient to produce, by natural means, the moſt wonderful phenomena which have ever been attributed to magical incantations. Even in our own days, we have the teſtimony of two travellers, whom we cannot ſuſpect to be either liars or enthuſiaſts, that both the Indians and Africans perform feats for which neither they nor the moſt enlightened Europeans can account. The one is Mr Groſe, who viſited the Eaſt Indies about the year 1762; and the other is Mr. Bruce, who informs us, that the inhabitants of the weſtern coaſts of Africa pretend to hold a communication with the devil, and verify their aſſertions in ſuch a manner that neither he nor other travellers know what to make of it: but it does not from this follow, that Mr. Bruce believed that communication to be real. We have all ſeen one of the moſt illiterate men that ever aſſumed the title of *Doctor*, perform feats very ſurpriſing, and ſuch as even a philoſopher would have been puzzled to account for, if he had not been previouſly let into the ſecret; and yet no man ſuppoſes that *Katterfelto* holds any communication with the devil, although he has ſometimes pretended it among people whoſe minds he ſuppoſed unenlightened.

Still it may be objected, that we have a vaſt number of hiſtories of witches, who in the laſt century confeſſed, that they were preſent with the devil at certain meetings; that they were carried through the air and ſaw many ſtrange feats performed, too numerous and too ridiculous to be here mentioned. The beſt anſwer to this objection ſeems to be that given by Dr Ferrier in his eſſay on Popular illuſions.* "The ſolemn meeting of witches (ſays he) are ſuppoſed to be put beyond all doubt by the numerous confeſſions of criminals, who have deſcribed their ceremonies, named the times and places of their meetings with the perſons preſent, and who have agreed in their relations, though ſeparately delivered. But I would obſerve, firſt, that the circumſtances told of thoſe feſtivals are in themſelves ridiculous and incredible; for they are repreſented as gloomy and horrible, and yet with a mixture of childiſh and extravagant fancies, more likely to diſguſt and alienate than conciliate the minds of their gueſts. They have every appearance of uneaſy dreams. Sometimes the devil and his ſubjects *ſay maſs*; ſometimes he *preaches* to them; more commonly he was ſeen in the form of a *black goat*, ſurrounded by imps in a thouſand frightful ſhapes; but none of theſe forms are *new*, they all reſemble known quadrupeds or reptiles. Secondly, I obſerve, that there is direct proof furniſhed even by demonologiſts, that *all* thoſe ſuppoſed journeys and entertainments were nothing more than dreams. Perſons accuſed of witchcraft have been repeatedly watched about the time they had fixed for their meeting: they have been ſeen to anoint themſelves with ſoporific compoſitions; after which they fell into profound ſleep; and on awaking ſeveral hours afterwards, they have related their journey through the air, with their amuſement at the feſtival, and have named the perſons whom they ſaw there." This is exactly conformable to the practice of the ancient magicians and diviners, and ſeems to be the true way of accounting, as well for many of the phenomena of magic, as for that extravagant and ſhameful ſuperſtition which prevailed ſo much during part of the laſt century, and by which ſuch numbers of innocent men and women were cruelly put to death (c). We may indeed be aſſured, that the devil has it not in his power to reverſe in a ſingle inſtance the laws of nature without a divine permiſſion; and we can conceive but one occaſion (ſee POSSESSION) on which ſuch permiſſion could be given conſiſtently with the wiſdom and the goodneſs of God. All the tales, therefore, of diabolical agency in magic and witchcraft muſt unboubtedly be falſe; for a power which the devil is not himſelf at liberty to exert, he cannot communicate to a human creature. Were the caſe otherwiſe; were thoſe powers, "which (according to Johnſon) only the controul of Omnipotence reſtrains from laying creation waſte, ſubſervient to the invocations of wicked mortals; were thoſe ſpirits—

———of which the leaſt could wield
The elements, and arm him with the force
of all their regions,"——permitted to work miracles, and either to inflict or to remove diſeaſes at the deſire of their capricious votaries, how comfortleſs and wretched would be the life of men! But the matter has been long ago determined by the failure of Phaoh's magicians; who, though by legerdemain they imitated ſome of the miracles of Moſes, could not form the vileſt inſect, or ſtand before the diſeaſe which he inflicted upon them as well as upon others. The

* Mancheſter Tranſactions, vol. 3.

(c) For ſome farther account of popular illuſions, ſee *Animal Magnetism*.

The revival of learning, and the ſucceſs with which the laws of nature have been inveſtigated, have long ago baniſhed this ſpecies of magic from all the enlightened nations of Europe. Among ourſelves, none but perſons groſsly illiterate pay the leaſt regard to magical charms; nor are they any where abroad more prevalent than among the inhabitants of Lapland and Iceland. Theſe people, indeed, place an abſolute confidence in the effects of certain idle words and actions; and ignorant ſailors from other parts of the world are deceived by their aſſertions and their ceremonies. The famous *magical drum* of the Laplanders is ſtill in conſtant uſe in that nation; and Sheffer, in his Hiſtory of Lapland, has given an account of its ſtructure.

This inſtrument is made of beech, pine, or fir, ſplit in the middle, and hollowed on the flat ſide where the drum is to be made. The hollow is of an oval figure; and is covered with a ſkin clean dreſſed, and painted with figures of various kinds, ſuch as ſtars, ſuns and moons, animals and plants, and even countries, lakes and rivers; and of later days, ſince the preaching of Chriſtianity among them, the acts and ſufferings of our Saviour and his apoſtles are often added among the reſt. All theſe figures are ſeparated by lines into three regions or cluſters.

There is, beſides theſe parts of the drum, an index and a hammer. The index is a bundle of braſs or iron rings, the biggeſt of which has a hole in its middle, and the ſmaller ones are hung to it. The hammer or drumſtick is made of the horn of a rein-deer; and with this they beat the drum ſo as to make theſe rings move, they being laid on the top for that purpoſe. In the motion of theſe rings about the pictures figured on the drum, they fancy to themſelves ſome prediction in regard to the things they inquire about.

What they principally inquire into by this inſtrument, are three things. 1. What ſacrifices will prove moſt acceptable to their gods. 2. What ſucceſs they ſhall have in their ſeveral occupations, as hunting, fiſhing, curing of diſeaſes, and the like; and, 3. What is doing in places remote from them. On theſe ſeveral occaſions they uſe ſeveral peculiar ceremonies, and place themſelves in various odd poſtures as they beat the drum; which influences the rings to the one or the other ſide, and to come nearer to the one or the other ſet of figures. And when they have done this, they have a method of calculating a diſcovery, which they keep as a great ſecret, but which ſeems merely the buſineſs of the imagination in the diviner or magician.

Magic Square, a ſquare figure, formed of a ſeries of numbers in mathematical proportion; ſo diſpoſed in parallel and equal ranks, as that the ſums of each row, taken either perpendicularly, horizontally, or diagonally, are equal.

Let the ſeveral numbers which compoſe any ſquare number (for inſtance, 1, 2, 3, 4, 5, &c. to 25 incluſive, the ſquare number) be diſpoſed, in their natural order, after each other in a ſquare figure of 25 cells, each in its cell; if now you change the order of theſe numbers, and diſpoſe them in the cells in ſuch manner, as that the five numbers which fill an horizontal rank of cells, being added together, ſhall make the ſame ſum with the five numbers in any other rank of cells, whether horizontal or vertical, and even the ſame number with the five in each of the two diagonal ranks: this diſpoſition of numbers is called a *magic ſquare*, in oppoſition to the former diſpoſition, which is called a *natural ſquare*. See the figures following:

Natural ſquare.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Magic ſquare.

16	14	8	2	25
3	22	20	11	9
15	6	4	23	17
24	18	12	10	1
7	5	21	19	13

One would imagine that theſe magic ſquares had that name given them in regard this property of all their ranks, which, taken any way, make always the ſame ſum, appeared extremely ſurpriſing, eſpecially in certain ignorant ages, when mathematics paſſed for magic; but there is a great deal of reaſon to ſuſpect, that theſe ſquares merited their name ſtill farther, by the ſuperſtitious operations they were employed in, as the conſtruction of taliſmans, &c. for, according to the childiſh philoſophy of thoſe days, which attributed virtues to numbers, what virtues might not be expected from numbers ſo wonderful?

However, what was at firſt the vain practice of makers of taliſmans and conjurors, has ſince become the ſubject of a ſerious reſearch among mathematicians; not that they imagine it will lead them to any thing of ſolid uſe or advantage. Magic ſquares ſavour too much of their original to be of much uſe; but only as it is a kind of play, where the difficulty makes the merit, and it may chance to produce ſome new views of numbers, which mathematicians will not loſe the occaſion of.

Eman. Moſchopulus, a Greek author of no great antiquity, is the firſt that appears to have ſpoken of magic ſquares: and by the age wherein he lived, there is reaſon to imagine he did not look on them merely as a mathematician. However, he has left us ſome rules for their conſtruction. In the treatiſe of Cor. Agrippa, ſo much accuſed of magic, we find the ſquares of ſeven numbers, viz. from three to nine incluſive, diſpoſed magically; and it muſt not be ſuppoſed that thoſe ſeven numbers were preferred to all the other without ſome very good reaſon: in effect, it is becauſe their ſquares, according to the ſyſtem of Agrippa and his followers, are planetary. The ſquare of 3, for inſtance, belongs to Saturn; that of 4 to Jupiter; that of 5 to Mars; that of 6 to the Sun; that of 7 to Venus; that of 8 to Mercury; and that of 9 to the Moon. M. Bachet applied himſelf to the ſtudy of magic ſquares, on the hint he had taken from the planetary ſquares of Agrippa, as being unacquainted with the work of Moſchopulus, which is only in manuſcript in the French king's library; and, without the aſſiſtance of any author, he found out a new method for thoſe ſquares whoſe root is uneven, for inſtance 25, 49, &c. but he could not make any thing of thoſe whoſe root is even.

After him came M. Frenicle, who took the ſame ſubject in hand. A certain great algebraiſt was of opinion, that whereas the 16 numbers which compoſe the ſquare might be diſpoſed 20922789888000 different ways in a natural ſquare (as from the rules of combination it is certain they may), they could not be diſpoſed in a magic ſquare above 16 different ways; but M. Frenicle ſhowed, that they might be thus diſpoſed 878 different ways: whence it appears how much his method exceeds the former, which only yielded the 55th part of magic ſquares of that of M. Frenicle.

To this inquiry he thought fit to add a difficulty that had not yet been conſidered: the magic ſquare of 7, for inſtance, being conſtructed, and its 49 cells filled, if the two horizontal ranks of cells, and, at the ſame time, the two vertical ones, the moſt remote from the middle be retrenched; that is, if the whole border or circumference of the ſquare be taken away, there will remain a ſquare whoſe root will be 5, and which will only conſiſt of 25 cells. Now it is not at all ſurpriſing that the ſquare ſhould be no longer magical, becauſe the ranks of the large ones were not intended to make the ſame ſum, excepting when taken entire with all the ſeven numbers that fill their ſeven cells; ſo that being mutilated each of two cells, and having loſt two of their numbers, it may be well expected; that their remainders will not any longer make the ſame ſum. But M. Frenicle would not be ſatisfied, unleſs when the circumference or border of the magic ſquare was taken away, and even any circumference at pleaſure, or, in fine, ſeveral circumferences at once, the remaining ſquare was ſtill magical: which laſt condition, no doubt, made theſe ſquares vaſtly more magical than ever.

Again, he inverted that condition, and required that any circumference taken at pleaſure, or even ſeveral circumferences, ſhould be inſeparable from the ſquare; that is, that it ſhould ceaſe to be magical when they were removed, and yet continue magical after the removal of any of the reſt. M. Frenicle, however, gives no general demonſtration of his methods, and frequently ſeems to have no other guide but chance. It is true, his book was not publiſhed by himſelf, nor did it appear till after his death, *viz.* in 1693.

In 1703, M. Poignard, canon of Bruſſels, publiſhed a treatiſe of ſublime magic ſquares. Before him there had been no magic ſquares made but for ſerieſes of natural numbers that formed a ſquare; but M. Poignard made two very conſiderable improvements. 1. Inſtead of taking all the numbers that fill a ſquare, for inſtance the 36 ſucceſſive numbers, which would fill all the cells of a natural ſquare, whoſe ſide is 6, he only takes as many ſucceſſive numbers as there are units in the ſide of the ſquare, which, in this caſe, are ſix; and theſe ſix numbers alone he diſpoſes in ſuch manner in the 36 cells that none of them are repeated twice in the ſame rank, whether it be horizontal, vertical, or diagonal; whence it follows, that all the ranks, taken all the ways poſſible, muſt always make the ſame ſum, which M. Poignard calls repeated progreſſion. 2. Inſtead of being confined to take theſe numbers according to the ſeries and ſucceſſion of the natural numbers, that is, in an arithmetical progreſſion, he takes them likewiſe in a geometrical progreſſion, and even in an harmonical progreſſion. But with theſe two laſt progreſſions the magic muſt neceſſarily be different to what it was: in the ſquares filled with numbers in geometrical progreſſion, it conſiſts in this, that the products of all the ranks are equal; and in the harmonical progreſſion, the numbers of all the ranks continually follow that progreſſion, he made ſquares of each of theſe three progreſſions repeated.

This book of M. Poignard gave occaſion to M. de la Hire to turn his thoughts the ſame way, which he did with ſuch ſucceſs, that he ſeems to have well nigh completed the theory of magic ſquares. He firſt conſiders uneven ſquares: all his predeceſſors on the ſubject having found the conſtruction of even ones by much the moſt difficult; for which reaſon M. de la Hire reſerves thoſe for the laſt. This exceſs of difficulty may ariſe partly from hence, that the numbers are taken in arithmetical progreſſion. Now in that progreſſion, if the number of terms be uneven, that in the middle has ſome properties, which may be of ſervice; for inſtance, being multiplied by the number of terms in the progreſſion, the product is equal to the ſum of all the terms.

M. de la Hire propoſes a general method for uneven ſquares, which has ſome ſimilitude with the theory of compound motions, ſo uſeful and fertile in mechanics. As that conſiſts in decompounding motions, and reſolving them into others more ſimple; ſo does M. de la Hire's method conſiſt in reſolving the ſquare that is to be conſtructed into two ſimple and primitive ſquares. It muſt be owned, however, it is not quite ſo eaſy to conceive thoſe two ſimple and primitive ſquares in the compound or perfect ſquare, as in an oblique motion to imagine a parallel and perpendicular one.

Suppoſe a ſquare of cells, whoſe root is uneven, for inſtance 7; and that its 49 cells are to be filled magically with numbers, for inſtance the firſt 7. M. de la Hire, on the one ſide, takes the firſt 7 numbers, beginning with unity, and ending with the root 7; and on the other 7, and all its multiples to 49, excluſively; and as theſe only make ſix numbers, he adds 0, which makes this an arithmetical progreſſion of 7 terms as well as the other: 0. 7. 14. 21. 28. 35. 42. This done, with the firſt progreſſion repeated, he fills the ſquare of the root 7 magically: in order to this, he writes in the firſt ſeven cells of the firſt horizontal rank the ſeven numbers propoſed in what order he pleaſes, for that is abſolutely indifferent; and it is proper to obſerve here, that thoſe ſeven numbers may be ranged in 5040 different manners in the ſame rank. The order in which they are placed in the firſt horizontal rank, be it what it will, is that which determines their order in all the reſt. For the ſecond horizontal rank, he places in its firſt cell, either the third, the fourth, the fifth, or the ſixth number, from the firſt number of the firſt rank; and after that writes the ſix others in order as they follow. For the third horizontal rank, he obſerves the ſame method with regard to the ſecond that he obſerved in the ſecond with regard to the firſt, and ſo of the reſt. For inſtance, ſuppoſe the firſt horizontal rank filled with the ſeven numbers in their natural order, 1, 2, 3, 4, 5, 6, 7; the ſecond horizontal rank may either commence with 3, with 4, with 5, or with 6: but in this inſtance it commences with 3; the third rank therefore muſt com-

1	2	3	4	5	6	7
3	4	5	6	7	1	2
5	6	7	1	2	3	4
7	1	2	3	4	5	6
2	3	4	5	6	7	1
4	5	6	7	1	2	3
6	7	1	2	3	4	5

mence with 5, the fourth with 7, the fifth with 2, the ſixth with 4, and the ſeventh with 6. The commencement of the ranks which follow the firſt being thus determined, the other numbers, as we have already obſerved, muſt be written down in the order wherein they ſtand in the firſt, going on to 5, 6, and 7, and returning to 1, 2, &c. till every number in the firſt rank be found in every rank underneath, according to the order arbitrarily pitched upon at firſt. By this means it is evident, that no number whatever can be repeated twice in the ſame rank; and by conſequence, that the ſeven numbers 1, 2, 3, 4, 5, 6, 7, being in each rank, muſt of neceſſity make the ſame ſum.

It appears, from this example, that the arrangement of the numbers in the firſt rank being choſen at pleaſure, the other ranks may be continued in four different manners: and ſince the firſt rank may have 5040 different arrangements, there are no leſs than 20160 different manners of conſtructing the magic ſquare of ſeven numbers repeated.

1	2	3	4	5	6	7
2	3	4	5	6	7	1
3	4	5	6	7	1	2
4	5	6	7	1	2	3
5	6	7	1	2	3	4
6	7	1	2	3	4	5
7	1	2	3	4	5	6

1	2	3	4	5	6	7
7	1	2	3	4	5	6
6	7	1	2	3	4	5
5	6	7	1	2	3	4
4	5	6	7	1	2	3
3	4	5	6	7	1	2
2	3	4	5	6	7	1

The order of the numbers in the firſt rank being determined; if in beginning with the ſecond rank, the ſecond number 2, or the laſt number 7, ſhould be pitched upon, in one of thoſe caſes and repeated; and in the other caſe, the other diagonal would be falſe unleſs the number repeated ſeven times ſhould happen to be 4; for four times ſeven is equal to the ſum of 1, 2, 3, 4, 5, 6, 7: and in general, in every ſquare conſiſting of an equal number of terms, in arithmetical progreſſion, one of the diagonals would be falſe according to thoſe two conſtructions, unleſs the term always repeated in that diagonal were the middle term of the progreſſion. It is not, however, at all neceſſary to take the terms in an arithmetical progreſſion; for, according to this method, one may conſtruct a magic ſquare of any numbers at pleaſure, whether they be according to any certain progreſſion or not. If they be in an arithmetical progreſſion, it will be proper, out of the general method, to except thoſe two conſtructions which produce a continual repetition of the ſame term in one of the two diagonals, and only to take in the caſe wherein that repetition would prevent the diagonal from being juſt; which caſe being abſolutely diſregarded when we computed that the ſquare of 7 might have 20,160 different conſtructions, it is evident that by taking that caſe in it muſt have vaſtly more.

To begin the ſecond rank with any other number beſides the ſecond and the laſt, muſt not, however, be looked on as an univerſal rule: it holds good for the ſquare of 7; but if the ſquare of 9, for inſtance, were to be conſtructed, and the fourth figure of the firſt horizontal rank were pitched on for the firſt of the ſecond, the conſequence would be, that the fifth and eighth horizontal ranks would likewiſe commence with the ſame number, which would therefore be repeated three times in the ſame vertical rank, and occaſion other repetitions in all the reſt. The general rule, therefore, muſt be conceived thus: Let the number in the firſt rank pitched on, for the commencement of the ſecond, have ſuch an exponent of its quota; that is, let the order of its place be ſuch, as that if an unit be taken from it, the remainder will not be any juſt quota part of the root of the ſquare; that is, cannot divide it equally. If, for example, in the ſquare of 7, the third number of the firſt horizontal rank be pitched on for the firſt of the ſecond, ſuch conſtruction will be juſt; becauſe the exponent of the place of that number, viz. 3, ſubtracting 1, that is, 2 cannot divide 7. Thus alſo might the fourth number of the ſame firſt rank be choſen, becauſe 4—1, viz. 3, cannot divide 7; and, for the ſame reaſon, the fifth or ſixth number might be taken: but in the ſquare of 9, the fourth number of the firſt rank muſt not be taken, becauſe 4—1, viz. 3, does divide 9. The reaſon of this rule will appear very evidently, by conſidering in what manner the returns of the ſame numbers do or do not happen, taking them always in the ſame manner in any given ſeries. And hence it follows, that the fewer diviſions the root of any ſquare to be conſtructed has, the more different manners of conſtructing it there are; and that the prime numbers, i. e. thoſe which have no diviſions, as 5, 7, 11, 13, &c. are thoſe whoſe ſquares will admit of the moſt variations in proportion to their quantities.

The ſquares conſtructed according to this method, have ſome particular properties not required in the problem; for the numbers that compoſe any rank parallel to one of the two diagonals, are ranged in the ſame order with the numbers that compoſe the diagonal to which they are parallel. And as any rank parallel to a diagonal muſt neceſſarily be ſhorter, and have fewer cells than the diagonal itſelf, by adding to it the correſpondent parallel, which has the number of cells by which the other falls ſhort of the diagonal, the numbers of thoſe two parallels, placed as it were end to end, ſtill follow the ſame order with thoſe of the diagonal: beſides that their ſums are likewiſe equal; ſo that they are magical on another account. Inſtead of the ſquares, which we have hitherto formed by horizontal ranks, one might alſo form them by vertical ones; the caſe is the ſame in both.

Firſt Primitive.

1	2	3	4	5	6	7
3	4	5	6	7	1	2
5	6	7	1	2	3	4
7	1	2	3	4	5	6
2	3	4	5	6	7	1
4	5	6	7	1	2	3
6	7	1	2	3	4	5

All we have hitherto ſaid regards only the firſt primitive ſquare, whoſe numbers, in the propoſed example, were 1, 2, 3, 4, 5, 6, 7; here ſtill remains the

Second Primitive.

0	7	14	21	28	35	42
21	28	35	42	0	7	14
42	0	7	14	21	28	35
14	21	28	35	42	0	7
35	42	0	7	14	21	28
7	14	21	28	35	42	0
28	35	42	0	7	14	21

ſecond primitive, whoſe numbers are 0, 7, 14, 21, 28, 35, 42. M. de la Hire proceeds in the ſame manner here as in the former; and this may likewiſe be conſtructed in 20,160 different manners, as containing the ſame number of terms with the firſt. Its conſtruction being made, and of conſequence all its ranks making the ſame ſum, it is evident, that if we bring the two into one, by adding together the numbers of the two correſponding cells of the two ſquares, that is, the two numbers of the firſt of each, the two numbers of the ſecond, of the third, &c. and diſpoſe them in the 49 correſponding cells of a third ſquare, it will likewiſe be magical in regard to its rank, formed by the addition of equal ſums to equal ſums, which muſt of neceſſity be equal among themſelves. All that remains in doubt is, whether or no, by the addition of the correſponding cells of the two firſt ſquares, all the cells of the third will be filled in ſuch manner, as that each not only contains one of the numbers of the progreſſion from 1 to 49, but alſo that this number be different from any of the reſt, which is the end and deſign of the whole operation.

As to this it muſt be obſerved, that if in the conſtructions of the ſecond primitive ſquare care has been taken, in the commencement of the ſecond horizontal rank, to obſerve an order with regard to the firſt different from what was obſerved in the conſtruction of the firſt ſquare; for inſtance, if the ſecond rank of the firſt ſquare began with the third term of the firſt rank, and the ſecond rank of the ſecond ſquare commence with the fourth of the firſt rank, as in the example it actually does; each number of the firſt ſquare may be combined once, and only once, by addition with all the numbers of the ſecond. And as the numbers of the firſt are here 1, 2, 3, 4, 5, 6, 7, and thoſe of the ſecond, 0, 7, 14, 21, 28, 35, 42, by combining them in this manner we have all the numbers in the progreſſion from 1 to 49, without having any of them repeated; which is the perfect magic ſquare propoſed.

Perfect Square.

1	9	17	25	33	41	49
24	32	40	48	7	8	16
47	6	14	15	23	31	39
21	22	41	38	46	5	13
37	47	4	12	20	28	29
11	19	27	35	36	46	3
34	42	43	2	10	18	26

The neceſſity of conſtructing the two primitive ſquares in a different manner does not at all hinder but that each of the 20,160 conſtructions of the one may be combined with all the 20,160 conſtructions of the other: of conſequence, therefore, 20,160 multiplied by itſelf, which makes 406,425,600, is the number of different conſtructions that may be made of the perfect ſquare, which here conſiſts of the 49 numbers of the natural progreſſion. But as we have already obſerved, that a primitive ſquare of ſeven numbers repeated may have above 20,160 ſeveral conſtructions, the number 406,425,600 muſt come vaſtly ſhort of expreſſing all the poſſible conſtructions of a perfect magic ſquare of the 49 firſt numbers.

As to the even ſquares, he conſtructs them like the uneven ones, by two primitive ſquares; but the conſtruction of primitives is different in general, and may be ſo a great number of ways: and thoſe general differences admit of a great number of particular variations, which give as many different conſtructions of the ſame even ſquare. It ſcarce ſeems poſſible to determine exactly, either how many general differences there may be between the conſtruction of the primitive ſquares of an even ſquare and an uneven one, nor how many particular variations each general difference may admit of; and, of conſequence, we are ſtill far from being able to determine the number of different conſtructions of all thoſe that may be made by the primitive ſquares.

The ingenious Dr Franklin ſeems to have carried this curious ſpeculation farther than any of his predeceſſors in the ſame way. He has conſtructed not only a magic ſquare of ſquares, but likewiſe a magic circle of circles, of which we ſhall give ſome account for the amuſement of our readers. The magic ſquare of ſquares is formed by dividing the great ſquare, as in Plate 294. fig. 1. The great ſquare is divided into 256 ſmall ſquares, in which all the numbers from 1 to 256 are placed in 16 columns, which may be taken either horizontally or vertically. The properties are as follow:

1. The ſum of the 16 numbers in each column, vertical and horizontal, is 2056.

2. Every half column, vertical and horizontal, makes 1028, or half of 2056.

3. Half a diagonal aſcending added to half a diagonal deſcending, makes 2056; taking theſe half diagonals from the ends of any ſide of the ſquare to the middle thereof; and ſo reckoning them either upward or downward, or ſidewiſe from left to right hand, or from right to left.

4. The ſame, with all the parallels to the half diagonals, as many as can be drawn in the great ſquare: for any two of them being directed upward and downward, from the place where they begin to that where they end, their ſums will make 2056. The ſame downward and upward in like manner: or all the ſame if taken ſideways to the middle, and back to the ſame ſide again. N. B. One ſet of theſe half diagonals and their parallels is drawn in the ſame ſquare upward and downward. Another ſuch ſet may be drawn from any of the other three ſides.

5. The four corner numbers in the great ſquare, added to the four central numbers therein, make 1028; equal to the half ſum of any vertical or horizontal column which contains 16 numbers; and equal to half a diagonal or its parallel.

6. If a ſquare hole (equal in breadth to four of the little ſquares) be cut in a paper, through which any of the 16 little ſquares in the great ſquare may be ſeen, and the paper be laid on the great ſquare, the ſum of all the 16 numbers, ſeen through the hole, is equal to the ſum of the 16 numbers in any horizontal or vertical column, viz. to 2056.

The magic circle of circles (fig. 2.) is compoſed of a ſeries of numbers from 12 to 75 incluſive, divided into eight concentric circular ſpaces, and ranged in eight radii of numbers, with the number 12 in the centre; which number, like the centre, is common to all theſe circular ſpaces, and to all the radii.

Magic Square

The numbers are ſo placed, that the ſum of all thoſe in either of the concentric circular ſpaces abovementioned, together with the central number 12, make 360; equal to the number of degrees in a circle.

The numbers in each radius alſo, together with the central number 12, make juſt 360.

The numbers in half of any of the above circular ſpaces, taken either above or below the double horizontal line, with half the central number 12, make 180; equal to the number of degrees in the ſemicircle.

If any four adjoining numbers be taken, as if in a ſquare, in the radial diviſions of theſe circular ſpaces, the ſum of theſe, with half the central number, make 180.

There are, moreover, included, four ſets of other circular ſpaces, bounded by circles which are eccentric with reſpect to the common centre; each of theſe ſets containing five ſpaces. The centres of the circles which bound them are at A, B, C, and D. The ſet whoſe centre is at A is bounded by dotted lines; the ſet whoſe centre is at B is bounded by lines of ſhort unconnected ſtrokes; and the ſet round D is bounded by lines of unconnected longer ſtrokes, to diſtinguiſh them from one another. In drawing this figure by hand, the ſet of concentric circles ſhould be drawn with black ink, and the four different ſets of eccentric circles with four kinds of ink of different colours; as blue, red, yellow, and green, for diſtinguiſhing them readily from one another. Theſe ſets of eccentric circular ſpaces interſect thoſe of the concentric, and each other; and yet the numbers contained in each of the eccentric ſpaces, taken all around through any of the 20 which are eccentric, make the ſame ſum as thoſe in the concentric, namely 360, when the central number 12 is added. Their halves alſo, taken above or below the double horizontal line, with half the central number, make 180.

Obſerve, that there is not one of the numbers but what belongs at leaſt to two of the circular ſpaces, ſome to three, ſome to four, ſome to five; and yet they are all ſo placed as never to break the required number 360 in any of the 28 circular ſpaces within the primitive circle.

To bring theſe matters in view, all the numbers as abovementioned are taken out, and placed in ſeparate columns as they ſtand around both the concentric and eccentric circular ſpaces, always beginning with the outermoſt and ending with the innermoſt of each ſet, and alſo the numbers as they ſtand in the eight radii, from the circumference to the centre; the common central number 12 being placed the loweſt in each column.

1. In the eight concentric circular ſpaces.

14	72	23	65	21	67	12	74
25	63	16	70	18	68	27	61
30	56	39	49	37	51	28	58
41	47	32	54	34	52	43	45
46	40	55	33	53	35	44	42
57	31	48	38	50	36	59	29
62	24	71	17	69	19	60	26
73	15	64	22	66	20	75	13
12	12	12	12	12	12	12	12
360	360	360	360	360	360	360	360

2. In the eight radii.

14	25	30	41	46	57	62	73
72	63	56	47	40	31	24	15
23	16	39	32	55	48	71	64
65	70	49	54	33	38	17	22
31	18	37	34	53	50	69	66
67	68	51	52	35	36	19	20
12	27	28	43	44	59	60	75
74	61	58	45	42	29	26	13
12	12	12	12	12	12	12	12
360	360	360	360	360	360	360	360

3. In the five eccentric circular ſpaces whoſe centre is at A.

14	72	23	85	21
63	16	70	18	68
39	49	37	51	28
54	34	52	43	45
33	53	35	44	42
48	38	50	36	59
24	71	17	69	19
73	15	64	22	66
12	12	12	12	12
360	360	360	360	360

4. In the five eccentric circular ſpaces whoſe centre is at B.

30	56	39	49	37
47	32	54	34	52
55	33	53	35	44
38	50	36	59	29
17	69	19	60	26
64	22	66	20	75
72	24	65	21	67
25	63	16	70	18
12	12	12	12	12
360	360	360	360	360

5. In the five eccentric circular ſpaces whoſe centre is at C.

46	40	55	33	53
31	48	38	50	36
71	17	69	19	60
22	66	20	75	13
65	21	67	12	74
16	70	18	68	27
56	39	49	37	51
41	47	32	54	34
12	12	12	12	12
360	360	360	360	360

6. In the five eccentric circular ſpaces whoſe centre is at D.

62	24	71	17	69
15	64	22	66	20
23	65	21	97	12
70	18	68	27	61
49	37	51	28	58
32	54	34	52	43
40	55	33	53	35
57	31	48	38	50
12	12	12	12	12
360	360	360	360	360

If, now, we take any four numbers as in a ſquare form, either from Nº 1. Nº 2. (as we ſuppoſe from Nº. 1.) as in the margin, and add half the central number 12 to them

14	72
25	63
6	

the

the ſum will be 180; equal to half the numbers in any circular ſpace taken above or below the double horizontal line, and equal to the number of degrees in a ſemicircle. Thus, 14, 72, 25, 63, and 6, make 180.

Magic Lantern. See Dioptrics, art. x. p. 37.

MAGICIAN, one who practiſes magic, or hath the power of doing wonderful feats by the agency of ſpirits.

Among the eaſtern nations it ſeems to have been formerly common for the princes to have magicians about their court to confer with upon extraordinary occaſions. And concerning theſe there hath been much diſputation: ſome ſuppoſing that their power was only feigned, and that they were no other than impoſtors who impoſed on the credulity of their ſovereigns; while others have thought that they really had ſome unknown connection or correſpondence with evil ſpirits, and could by their means accompliſh what otherwiſe would have been impoſſible for men. See the article Magic.

MAGINDANAO, or Mindanao. See Mindanao.

MAGISTERY, in chemiſtry, a name given to almoſt all precipitates. Thus, *magiſtery* and *precipitate* are ſynonymous: but chemiſts chiefly uſe *precipitates* as a general term, and apply that of *magiſtery* to ſome particular precipitates only which are uſed in medicine and in the arts. Such are, the magiſteries of biſmuth, coal, crabs-eyes, ſulphur, &c.

Magistery *of Biſmuth.* See Chemistry, n° 766.

MAGISTRATE, any public officer to whom the executive power of the law is committed either wholly or in part.

MAGLIABECHI (Anthony), a perſon of great learning, and remarkable for an amazing memory, was born at Florence in 1633. His father died when he was only ſeven years old. His mother had him taught grammar and drawing, and then put him apprentice to one of the beſt goldſmiths in Florence. When he was about 16 years old, his paſſion for learning began to ſhow itſelf; and he laid out all his money in buying books. Becoming acquainted with Michael Ermini, librarian to the cardinal de Medicis, he ſoon perfected himſelf by his aſſiſtance in the Latin tongue, and in a little time became maſter of the Hebrew. His name ſoon became famous among the learned. A prodigious memory was his diſtinguiſhing talent; and he retained not only the ſenſe of what he had read, but frequently all the words, and the very manner of ſpelling. It is ſaid that a gentleman, to make trial of the force of his memory, lent him a manuſcript he was going to print. Some time after it was returned, the gentleman, coming to him with a melancholy countenance, pretended it was loſt, and requeſted Magliabechi to recollect what he remembered of it; upon which he wrote the whole, without miſſing a word. He generally ſhut himſelf up the whole day, and opened his door in the evening to the men of letters who came to converſe with him. His attention was ſo abſorbed by his ſtudies, that he often forgot the moſt urgent wants of nature. Coſmo III. grand duke of Florence, made him his librarian; but he ſtill continued negligent in his dreſs, and ſimple in his manners. An old cloak ſerved him for a morning-gown in the day and for bed-clothes at night. The duke, however, provided for him a commodious apartment in his palace, which he was with difficulty perſuaded to take poſſeſſion of; but which he quitted four months after, and returned to his houſe. He was remarkable for his extraordinary modeſty, his ſincerity, and his beneficence, which his friends often experienced in their wants. He was a patron of men of learning; and had the higheſt pleaſure in aſſiſting them with his advice and information, and in furniſhing them with books and manuſcripts. He had the utmoſt averſion at any thing that looked like conſtraint; and therefore the grand duke always diſpenſed with his perſonal attendance, and ſent him his orders in writing. Though he lived a moſt ſedentary life, he reached the 81ſt year of his age; and died in the midſt of the public applauſe, after enjoying, during the latter part of his life, ſuch affluence as few have ever procured by their learning. By his will, he left a very fine library to the public, with a fund for its ſupport.

MAGLOIRE (St), a native of Wales in Great Britain, and couſin-german to St Sampſon and St Malo. He embraced a monaſtic life, and went into France, where he was made abbot of Dol, and after that a provincial biſhop in Brittany. He afterwards founded a monaſtery in the iſland of Jerſey, where he died on the 14th of October 575, about the age of 80. His remains were tranſported to the ſuburbs of St Jacques, and depoſited in a monaſtery of Benedictines, which was ceded to the fathers of the oratory in 1698. It is now the ſeminary of St Magloire, celebrated on account of the learned men whom it has produced.—This ſaint cultivated poetry with conſiderable ſucceſs: the hymn which is ſung at the feaſt of All Saints was compoſed by him; *Cælo quos eadem gloria conſecrat*, &c.

MAGNA assisa eligenda, is a writ anciently directed to the ſheriff for ſummoning four lawful knights before the juſtices of aſſize, in order to chuſe 12 knights of the neighbourhood, &c. to paſs upon the great aſſize between ſuch a perſon plaintiff and ſuch a one defendant.

Magna Charta. See Charta.

MAGNANIMITY, denotes greatneſs of mind, particularly in circumſtances of trial and adverſity.—Mr Stretch ‡ well obſerves of it, that it is the good ſenſe of pride, and the nobleſt way of acquiring applauſe. It renders the ſoul ſuperior to the trouble, diſorder, and emotion which the appearance of great danger might excite; and it is by this quality that heroes maintain their tranquillity, and preſerve the free uſe of their reaſon in the moſt ſurpriſing and dreadful accidents. It admires the ſame quality in its enemy; and fame, glory, conqueſts, deſire of opportunities to pardon and oblige their oppoſers, are what glow in the minds of the brave. Magnanimity and courage are inſeparable.

1. The inhabitants of Privernum being ſubdued and taken priſoners after a revolt, one of them being aſked by a Roman ſenator, who was for putting them all to death, what puniſhment he and his fellow captives deſerved? anſwered with great intrepidity, "We deſerve that puniſhment which is due to men who are jealous of their liberty, and think themſelves worthy of it." Plautinus perceiving that his anſwer exaſperated ſome of the ſenators, endeavoured to prevent

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‡ *Beauties of Hiſtory*, under the word.

the ill effects of it, by putting a milder queſtion to the priſoner: "How would you behave (ſays he) if Rome ſhould pardon you?" "Our conduct (replied the generous captive) depends upon yours. If the peace you grant be an honourable one, you may depend on a conſtant fidelity on our parts; if the terms of it be hard and diſhonourable, lay no ſtreſs on our adherence to you." Some of the judges conſtrued theſe words as menaces; but the wiſer part finding in them a great deal of magnanimity, cried out, that a nation whoſe only deſire was liberty, and their only fear that of loſing it, was worthy to become Roman. Accordingly, a decree paſſed in favour of the priſoners, and Privernum was declared a municipium. Thus the bold ſincerity of one man ſaved his country, and gained it the privilege of being incorporated into the Roman ſtate.

2. Subrius Flavius, the Roman tribune, being impeached for having conſpired againſt the life of the emperor Nero, not only owned the charge, but gloried in it. Upon the emperor's aſking him what provocation he had given him to plot his death? "Becauſe I abhorred thee (ſaid Flavius), though there was not in the whole army one more zealouſly attached to thee than I, ſo long as thou didſt merit affection; but I began to hate thee when thou becameſt the murderer of thy mother, the murderer of thy brother and wife, a charioteer, a comedian, an incendiary, and a tyrant." Tacitus tells us, that the whole conſpiracy afforded nothing which proved ſo bitter and pungent to Nero as this reproach. He ordered Flavius to be immediately put to death, which he ſuffered with amazing intrepidity. When the executioner deſired him to ſtretch out his neck valiantly, "I wiſh (replied he) thou mayeſt ſtrike as valiantly."

3. When the Scythian ambaſſadors waited on Alexander the Great, they gazed attentively upon him for a long time without ſpeaking a word, being very probably ſurpriſed, as they formed a judgment of men from their air and ſtature, to find that his did not anſwer the high idea they entertained of him from his fame. At laſt, the oldeſt of the ambaſſadors (according to Q. Curtius) addreſſed him thus: "Had the gods given thee a body proportionable to thy ambition, the whole univerſe would have been too little for thee. With one hand thou wouldſt touch, the caſt, and with the other the weſt; and, not ſatisfied with this, thou wouldſt follow the ſun, and know where he hides himſelf. But what have we to do with thee? we never ſet foot in thy country. May not thoſe who inhabit woods be allowed to live, without knowing who thou art and whence thou comeſt? We will neither command over, nor ſubmit to, any man. And that thou mayeſt be ſenſible what kind of people the Scythians are, know, that we received from heaven as a rich preſent, a yoke of oxen, a ploughſhare, a dart, a javelin, and a cup. Theſe we make uſe of, both with our friends and againſt our enemies. To our friends we give corn, which we procure by the labour of our oxen; with them we offer wine to the gods in our cup; and with regard to our enemies, we combat them at a diſtance with our arrows, and near at hand with our javelins. But thou, who boaſted thy coming to extirpate robbers, thou thyſelf art the greateſt robber upon earth. Thou haſt plundered all nations thou overcameſt: thou haſt poſſeſſed thyſelf of Lydia, invaded Syria, Perſia, and Bactriana; thou art forming a deſign to march as far as India; and now thou comeſt hither to ſeize upon our herds of cattle. The great poſſeſſions thou haſt, only make thee covet more eagerly what thou haſt not. If thou art a god, thou oughteſt to do good to mortals, and not deprive them of their poſſeſſions. If thou art a mere man, reflect always on what thou art. They whom thou ſhalt not moleſt will be thy true friends, the ſtrongeſt friendſhips being contracted between equals; and they are eſteemed equals who have not tried their ſtrength againſt each other: but do not imagine that thoſe whom thou conquereſt can love thee."

Rapin's Hiſt. an. 1199.

4. Richard I. king of England, having inveſted the caſtle of Chalus, was ſhot in the ſhoulder with an arrow; an unſkilful ſurgeon endeavouring to extract the weapon, mangled the fleſh in ſuch a manner, that a gangrene enſued. The caſtle being taken, and perceiving he ſhould not live, he ordered Bertram de Gourdon, who had ſhot the arrow, to be brought into his preſence. Bertram being come, "What harm (ſaid the king) did ever I do to thee, that thou ſhouldſt kill me?" The other replied with great magnanimity and courage, "You killed with your own hand my father and two of my brothers, and you likewiſe deſigned to have killed me. You may now ſatiate your revenge. I ſhould cheerfully ſuffer all the torments that can be inflicted, were I ſure of having delivered the world of a tyrant who filled it with blood and carnage." This bold and ſpirited anſwer ſtruck Richard with remorſe. He ordered the priſoner to be preſented with one hundred ſhillings, and ſet at liberty; but Maccardec, one of the king's friends, like a true ruffian, ordered him to be flayed alive.

5. The following modern inſtance is extracted from a late French work intitled, *Ecole hiſtorique & morale du ſoldat*, &c. A mine, underneath one of the outworks of a citadel, was intruſted to the charge of a ſerjeant and a few ſoldiers of the Piedmonteſe guards. Several companies of the enemy's troops had made themſelves maſters of this work; and the loſs of the place would probably ſoon have followed had they maintained their poſt in it. The mine was charged, and a ſingle ſpark would blow them all into the air. The ſerjeant, with the greateſt coolneſs, ordered the ſoldiers to retire, deſiring them to requeſt the king to take care of his wife and children; ſtruck fire, ſet a match to the train, and ſacrificed himſelf for his country.

MAGNESA, or MAGNESIA, (anc. geog.) a town or a diſtrict of Theſſaly, at the foot of mount Pelius, called by Philip, the ſon of Demetrius, one of the three keys of Greece, (Pauſanias.)

MAGNESIA, or MAGNESIA ALBA, in mineralogy and chemiſtry, a kind of earth only diſcovered ſince the beginning of this century. It firſt began to be known at Rome by the name of the *Count de Palma's powder*, which a canon there offered as a general remedy for all diſorders. It was by many conſidered as a calcareous earth; but F. Hoffman ſhowed it to be eſſentially diſtinct. The ſame was afterwards done by

Dr Black of Edinburgh and M. Margraaf of Berlin, though unknown to each other at the time. When pure it is extremely white, looſe, and light; the ſpecific gravity about 2.330. It is one of the moſt infuſible ſubſtances in nature; neither melting, nor even hardening nor contracting, in the focus of the moſt powerful burning-glaſs. An experiment was made on ſome of this earth in the ſummer of 1782 by M. Magellan, with Mr Parker's burning-glaſs; the effects of which are more powerful than thoſe of any other, though its diameter is only 32 inches. The event ſeemed at firſt to be unfavourable to the concluſion abovementioned; for a cubic inch of magneſia, a quarter of an inch each ſide, being put into its focus was hardened, and reduced to leſs than a third part of its bulk each way, viz. from .25 of an inch to .08. On applying a ſimilar cube of magneſia, however, from Mr Henry's manufacture at Mancheſter, it neither became harder nor ſenſibly diminiſhed in ſize. Bergman informs us, that magneſia, unleſs precipitated by the volatile alkali, or that by the neat alkaliſed tartar, always contains ſome ſiliceous or calcareous earth. Almoſt the ſame thing happens when it is ſeparated by calcination from the remaining lixiviations of the nitrous and marine acids; in which caſe, by ſuch a violent fire, it adheres together, and even ſhows a tendency to vitrify.

Notwithſtanding this extreme refractorineſs of magneſia by itſelf, it melts eaſily with borax, though ſcarce affected by alkalies or the calces of lead; when mixed with other earths it produces hard maſſes of various kinds; when mixed with calcareous, argillaceous, or ſiliceous earths, it melts in the fire; and if four times its weight of green glaſs be added to it, the maſs forms a kind of porcelain ſo hard as to ſtrike fire with ſteel. But neither an equal part of the above earths, nor of ponderous earth, glaſs of lead, vegetable alkali, nor vitriolated tartar, added ſeparately to magneſia, will melt in the fire: however, when mixed with common argillaceous earth, it melts into a hard maſs. Magneſia differs from calcareous earth in having a much ſmaller attraction for fixed air. In this reſpect it is inferior even to fixed alkaline ſalts; ſo that it will not render any of theſe cauſtic, though it will do ſo to the volatile alkali. It alſo parts very readily with its own fixed air by mere heat; and it was by making experiments on this ſubſtance that Dr Black made his firſt diſcoveries concerning fixed air. In its calcined ſtate, however, it does not ſhow any of the cauſticity of lime, but may be ſafely taken internally; and is even preferred by ſome to that which contains fixed air. In this ſtate it is much leſs ſoluble than when combined with fixed air, and does not effervеſce with any acid. When mixed with water, a very ſmall degree of heat is excited, and in about 7962 times its weight of water it totally diſſolves. It diſſolves alſo very readily in aerial acid; by which means it is frequently united with freſh water. For the ſame reaſon, when we mix a ſolution of perfectly mild alkali, either fixed or volatile, with a ſolution of magneſia, no precipitation follows; becauſe the great quantity of fixed air extricated by the union of the acid and alkali, inſtantly diſſolves the precipitate as faſt as it is formed. But if we put this mixture over the fire, it will grow thick, and coagulate as ſoon as it is heated to a certain degree; becauſe the magneſia is unable to retain, in any conſiderable heat, as much fixed air as is neceſſary for its ſolution.

On putting magneſia into water, and afterwards drying it, it is found to retain $\frac{18}{100}$ of its weight of aqueous fluid; but when fully ſaturated with aerial acid, it will abſorb and retain $\frac{66}{100}$ of the ſame. When fully ſaturated with aerial acid, it is more ſoluble in cold than in hot water; becauſe the heat of the latter diſſipates part of the fixed air, as was obſerved concerning the alkaline ſalts.

Magneſia, when combined with different acids, forms ſalts exceedingly different from thoſe produced by calcareous earth under ſimilar circumſtances; and of which an account is given under the article CHEMISTRY. It is uſually prepared either from the bittern of ſea-ſalt, or from the ſalt prepared from that liquid under the name of Epſom ſalt. The magneſia prepared directly from the bittern, however, is by no means equal in purity to that produced from the finer kinds of Epſom ſalt. Hence, in order to have pure magneſia, Bergman gives the following directions: "Let Epſom ſalt, in well-formed cryſtals, be diſſolved in diſtilled water; and from this the magneſia is to be precipitated by mild volatile alkali. Some of this earth that remains ſuſpended in the ſolution, by means of aerial acid, may be eaſily precipitated by a ſimple ebullition. An hundred pounds of this magneſia, when rightly prepared, contains near 25 parts of fixed air, 30 of water, and 45 of pure earth. Its ſpecific gravity is then 2.155. This method of preparation may anſwer very well for having a very pure magneſia; but when it is required to have it very light and ſpongy, which, by thoſe who uſe it, is looked upon to be the only criterion of its goodneſs, we muſt uſe the following method:

Take any quantity of Epſom ſalt, diſſolve it in boiling water, and filter the ſolution. Diſſolve alſo half the quantity of good pearl-aſh, and filter this ſolution. Both of theſe ſolutions ought to be ſomewhat diluted; and it will be proper to uſe twice the quantity of water which would fairly diſſolve the ſalts. Mix the two ſolutions when nearly cold, and ſtir them very well together. Let the mixture ſtand for ſome hours until the precipitate has fallen to the bottom in form of a coarſe gritty powder. Put the whole then into a clean copper kettle, under which a moderate fire is made. Stir the matter inceſſantly with a large wooden ſpatula, to prevent the powder from ſticking to the bottom. As the mixture heats, the powder begins to looſe its ſandy appearance, and to increaſe greatly in quantity; ſo that, though at firſt the mixture was quite thin, with only a ſmall portion of ſandy matter amongſt it, before it has attained the boiling heat it will be ſo thick that it can ſcarce be ſtirred. When the grittineſs is quite gone, the matter muſt be put upon a filtering cloth, and warm water poured upon it till it runs inſipid. The magneſia is then to be put upon chalk ſtones, which will abſorb the greateſt part of the moiſture; and it may at laſt be fully dried in a ſtove.

Magneſia alba is a good abſorbent; and undoubtedly to be preferred to crab's-eyes, on account of its purgative quality when united with an acid, which the other has not. It has been eſteemed hurtful in bilious habits where there is a diſpoſition in the ſtomach contrary to acidity. This, however, according to Mr Henry, is doubtful: and where putrid bile is to be corrected, he thinks good purpoſes may be anſwered by taking magneſia with an acid in a ſtate of efferveſcence; as the fixed air, thus extricated, will correct the putridity of the contents of the inteſtines, while they are at the ſame time evacuated downwards. He is alſo of opinion, that in cutaneous diſeaſes it may enter the circulation in form of a neutral ſalt, and, by acting as a diaphoretic and diuretic, prove an excellent alterative. For ſome medical purpoſes, magneſia is uſed in a calcined ſtate; in which caſe it is deprived of its fixed air, and then it proves nearly as aperient as a double quantity of magneſia in its uncalcined ſtate. Mr Henry is of opinion, that it may be uſeful in diſtenſions of the bowels ariſing from flatus; that it may be ſucceſsfully employed as a cathartic with patients labouring under the ſtone, who are uſing the lixivium ſaponaceum; and that, joined with warm aromatics, it may be of ſervice in correcting the great flatulency which ſo much afflicts people of a gouty diſpoſition. From ſeveral experiments made by the ſame author, it alſo appears that magneſia has a conſiderable antiſceptic power. The like virtue he aſcribes to all kinds of teſtaceous powders: whence he concludes, that medicines of this kind are by no means improper in fevers of a putreſcent type; that where bile is ſuſpected to be the cauſe of any putrid diſeaſe, thoſe antiſeptics ſhould be preſcribed which particularly impede its corruption; that, as calcined magneſia is a more powerful antiſeptic than moſt other abſorbents, it merits a preference to theſe; and that where an acid cacochymy prevails, magneſia or other abſorbonts, taken immediately before or after meal-time, may, by increaſing the putrefactive fermentation of animal-food, be of very great ſervice. He hath alſo found, that magneſia hath a power of promoting the ſolution of reſinous gums in water; and thus we have an elegant and eaſy method of preparing aqueous tinctures from theſe ſubſtances. Such tinctures, however, are calculated only for extemporaneous preſcription, as moſt of them depoſit a ſediment when they have been kept a week or two.

Black MAGNESIA. See MANGANESE.

MAGNESIA (anc. geog.), a maritime diſtrict of Theſſaly, lying between the ſouth part of of the Simus Thermaicus and the Pegaſæus to the ſouth, and to the eaſt of the Pelaſgiotis. *Magnetes*, the people. *Magneſius* and *Magneſſus*, the epithet; (Horace).

MAGNESIA, a town of Aſia Minor on the Mæander, about 15 miles from Epheſus. Themiſtocles died there: it was one of the three towns given him by Artaxerxes, with theſe words, "to furniſh his table with bread." It is alſo celebrated for a battle which was fought there, 190 years before the Chriſtian æra, between the Romans and Antiochus king of Syria. The forces of Antiochus amounted to 70,000 men according to Appian, or 70,000 foot and 12,000 horſe according to Livy, which has been exaggerated by Florus to 300,000 men; the Roman army conſiſted of about 28 or 30,000 men, 2000 of which were employed in guarding the camp. The Syrians loſt 50,000 foot and 4000 horſe; and the Romans only 300 killed, with 25 horſe. It was founded by a colony from Magneſia in Theſſaly; and was commonly called *Magneſia ad Mæandrum*, to diſtinguiſh it from another, called *Magneſia ad Sipylum* in Lydia at the foot of Mount Sipylus.

Magnesia ad Sipylum, anciently *Tantalis*, the reſidence of Tantalus, and capital of Mæonia, where now ſtands the lake Sale. A town of Lydia, at the foot of mount Sipylus, to the eaſt of the Hermus; adjudged free under the Romans. It was deſtroyed by an earthquake in the reign of Tiberius.

MAGNET, (*Magnes*), the LOADSTONE: a ſort of ferruginous ſtone, in weight and colour reſembling iron ore, though ſomewhat harder and more heavy; endowed with various extraordinary properties, attractive, directive, inclinatory, &c. See MAGNETISM.

The magnet is alſo called *Lapis Heracleus*, from Heraclea, a city of Magneſia, a port of the ancient Lydia, where it is ſaid to have been firſt found, and from which it is uſually ſuppoſed to have taken its name. Though others derive the word from a ſhepherd named *Magnes*, who firſt diſcovered it with the iron of his crook on mount Ida. It is alſo called *Lapis Nauticus*, by reaſon of its uſe in navigation; and *ſiderites*, from its attracting iron, which the Greeks call σιδηρος.

The magnet is uſually found in iron mines, and ſometimes in very large pieces half magnet half iron. Its colour is different according to the different countries it is brought from. Norman obſerves, that the beſt are thoſe brought from China and Bengal, which are of an irony or ſanguine colour; thoſe of Arabia are reddiſh; thoſe of Macedonia blackiſh; and thoſe of Hungary, Germany, England, &c. the colour of unwrought iron. Neither its figure nor bulk is determinate, it is found of all forms and ſizes.

The ancients reckoned five kinds of magnets, different in colour and virtue; the Ethiopic, Magneſian, Bœotic, Alexandrian, and Natolian. They alſo took it to be male and female: but the chief uſe they made of it was in medicine; eſpecially for the cure of burns and defluxions on the eyes.—The moderns, more happy, employ it to conduct them in their voyages. See NAVIGATION.

The moſt diſtinguiſhing properties of the magnet, are, That it attracts iron, and that it points to the poles of the world; and in other circumſtances alſo dips or inclines to a point beneath the horizon, directly under the pole; and that it communicates theſe properties, by touch, to iron. On which foundation are built the mariner's needles, both horizontal and inclinatory.

Attractive Power of the MAGNET was known to the ancients; and is mentioned even by Plato and Euripides, who call it the *Herculean ſtone*, becauſe it commands iron, which ſubdues every thing elſe: but the knowledge of its directive power, whereby it diſpoſes its poles along the meridian of every place, and occaſions needles, pieces of iron, &c. touched with it, to point nearly north and ſouth, is of a much later date; though the exact time of its diſcovery, and the diſcoverer himſelf, are yet in the dark. The firſt tidings we hear of it is in 1260, when Marco Polo the Venetian is ſaid by ſome to have introduced the mariner's compaſs; though not as an invention of his own, but as derived from the Chineſe, who are ſaid to have had the uſe of it long before; though ſome imagine that the Chineſe rather borrowed it from the Europeans.

Flavio de Gioia, a Neapolitan, who lived in the 13th century, is the perſon uſually ſuppoſed to have the beſt title to the diſcovery: and yet Sir G. Wheelen mentions, that he had ſeen a book of aſtronomy much older, which ſuppoſed the uſe of the needle; though not as applied to the uſes of navigation, but of aſtronomy. And in Guyot de Provins, an old French poet, who wrote about the year 1180, there is an expreſs mention made of the load ſtone and compaſs; and their uſe in navigation obliquely hinted at.

The Variation of the MAGNET, or its declination from the pole, was firſt diſcovered by Seb. Cabot, a Venetian, in 1500; and the variation of that variation, by Mr Gellibrand, an Engliſhman, about the year 1625. See VARIATION.

Laſtly, the dip or inclination of the needle, when at liberty to play vertically, to a point beneath the horizon, was firſt diſcovered by another of his countrymen, Mr R. Norman, about the year 1576. See the article *Dipping-*NEEDLE

MAGNETICAL NEEDLE. See *Magnetical* NEEDLE.

MAGNETISM.

THE power by which the load-ſtone is influenced, manifeſting itſelf by certain attractive and directive virtues, and which may be underſtood from the following phenomena afterwards mentioned, which are common to all magnetical bodies.

CHAP. I. *Phenomena and Laws of Magnetiſm.*

§ 1. *Phenomena of the Magnet.*

1. A Magnet, whether natural or artificial, attracts iron, and all ſubſtances which contain it in its metallic ſtate. A pure calx of iron is but little attracted; but if the calx be heated ſtrongly in conjunction with charcoal duſt, it will then be attracted, though it has not regained its metallic ſplendour, and is quite deſtitute of malleability. The ſemimetal called *nickel*, and perhaps ſome others, are attracted by the magnet, though freed from iron as much as poſſible. From ſome accounts it has been ſuſpected that braſs was in a ſmall degree affected by the magnet, and even that all very minute bodies are ſomewhat under its influence; but this ſeems not yet to be ſufficiently aſcertained.

2. If a magnet be ſuſpended by a thread, nicely placed on a pivot, or ſet to float in a baſon of water, it will turn one and conſtantly the ſame ſide nearly towards the north pole of the earth, the other of courſe turning towards the ſouth. Hence theſe parts of the magnet have been called its poles, taking the deſignations of north and ſouth from thoſe parts of the world towards which they turn. This property is called the *polarity* of the magnet; and when it is in the act of turning itſelf into this poſition, it is ſaid to *traverſe*. A plane drawn perpendicular to the horizon through both poles of a magnet, after it has turned itſelf, is called the *magnetic meridian*; and the angle it makes with the meridian of the place is called the *declination* of the magnet or of the magnetic needle.

3. When either the north or the ſouth poles of two magnets are placed near to each other, they repel; but a north and a ſouth pole attract each other.

4. A magnet placed in ſuch a manner as to be entirely at liberty, inclines one of its poles to the horizon, and of courſe elevates the other above it. This property is called the *inclination* or *dipping* of the magnet; and is moſt conſpicuous in artificial magnets or needles; which may be accurately balanced before the magnetic virtue is imparted to them.

5. By proper management any magnet may be made to communicate its virtue to a piece of ſteel or iron, which virtue it will retain for a longer or ſhorter time according to circumſtances.

§ 2. *Of the different Subſtances attracted by the Magnet.*

It has already been ſaid, that iron is the only ſubſtance which the magnet particularly attracts, and that too when in its metallic ſtate. Nevertheleſs this metal is ſo univerſally diffuſed, that there are few ſubſtances which do not contain a ſufficient quantity of it to be in ſome degree affected by the magnet. Iron itſelf is attracted with different degrees of force according to the ſtate in which it is with regard to malleability.—Even the pureſt calx or ſolution that can be made, is ſaid to be in ſome degree affected by the magnet; but of all ſubſtances ſoft iron is attracted with the greateſt force when clean and of an uniform texture. Hardened ſteel is attracted with much leſs force than iron; but the ſcales ſeparated from red-hot iron, the fuſed globules from flint and ſteel, or the finery cinder, are attracted as much as iron itſelf. The black calx of iron is attracted but very weakly; and the red calx or ruſt ſo little, that it is generally ſaid to be quite inſenſible to the magnetic attraction; though this is not found to be ſtrictly true, even when the calx is prepared by fire, and purified in the moſt careful manner. Sometimes the ſcales and calx are capable of acquiring a polarity, though weakly. Ores of iron are attracted with greater or leſs force according to the ſtate of the metal in them, and according to the quantity of it they contain; though the attraction is always manifeſt even when they contain ſuch a ſmall quantity as ſcarcely to deſerve the name of ores. They are generally much more attracted after calcination than before; becauſe this operation communicates to them a portion of phlogiſton by which they approach to a metallic ſtate. Ores of lead, tin, and copper, are likewiſe attracted, as well as native cinnabar, on account of the quantity of iron they contain; and it is remarkable, that though pure lead in its metallic ſtate is not in the leaſt attracted, its calx is ſo in ſome degree. The calx of tin is alſo attracted, though in a ſtill ſmaller degree than that of lead. Zinc, biſmuth, and cobalt, but eſpecially the ores of theſe ſemimetals, are attracted; but not antimony, unleſs it be firſt expoſed to a gentle heat; and arſenic is not attracted at all. One kind of biſmuth is ſaid to be abſolutely repelled by the magnet. Almoſt all other minerals are attracted, at leaſt after having been expoſed to the action

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tion of fire. Calcareous earth is attracted leſs than any other kind, and the ſiliceous earth the moſt frequently. Sand, eſpecially the black kind, is generally attracted; and amber as well as other combuſtible ſubſtances have the ſame property, after being burned. Almoſt every part of animal and vegetable bodies is affected by the magnet after being burned; but unburned animal or vegetable ſubſtances are very ſeldom if ever perceptibly attracted. It is alſo remarkable, that even ſoot, or the duſt which falls upon any thing left expoſed to the atmoſphere, are ſenſibly attracted. Colourleſs precious ſtones, as the diamond and cryſtals, are not attracted; neither the amethyſt, topaz, chalcedony, or ſuch as are deprived of their colour by fire; but all others, as the ruby, chryſolite, and tourmalin, are attracted. The emerald, and particularly the garnet, are not only attracted, but frequently acquire an evident polarity. The opal is attracted but weakly.

The attraction of ſo many different ſubſtances ſhows the univerſal diffuſion of iron throughout almoſt all terreſtrial ſubſtances; for to this we are with the greateſt probability to aſcribe the attraction of ſo many ſubſtances by the magnet. How ſmall a quantity of iron indeed will give a ſubſtance this property, is evident from the following experiment related by Mr Cavallo. "Having choſen a piece of Turkey-ſtone which weighed above an ounce, I examined it by a very ſenſible magnet needle, but did not find that it was affected in the leaſt. A piece of ſteel was then weighed with a pair of ſcales, which would turn with the 20th part of a grain, and one end of it drawn over the ſtone in the various directions. After this operation the ſteel was again weighed, and found to have loſt no perceptible part of its weight; yet the Turky-ſtone, which had acquired only this very ſmall quantity of ſteel, now affected the magnetic needle very ſenſibly." In making his obſervations on this experiment, he propoſes the magnet as a teſt of iron in different ſubſtances, being capable of detecting a ſmaller quantity than any method that chemiſtry can yet afford.

Our author has been at conſiderable pains to inveſtigate the magnetic properties of braſs and other metals; having made many experiments upon the ſubject, of which the following are the reſults: 1. Hammered braſs is much more generally attracted by the magnet than other kinds; and ſuch as is not influenced in this manner, acquires the property by being hammered. 2. A piece of braſs rendered magnetic by hammering, loſes the property on being made red hot ſo as to become ſoftened; by a ſecond hammering it becomes again magnetic; and thus may be made to loſe its property and recover it alternately. 3. Suſpecting that the magnetic property might be occaſioned by a ſmall quantity of iron abraded from the hammer, the pieces of braſs were beat between two pieces of card-paper; notwithſtanding which precaution, it acquired the magnetic property as before. 4. Sometimes an evident degree of magnetiſm was communicated by two or three ſtrokes, and with the card-paper not above 30 ſtrokes were given to make the braſs ſenſibly magnetic. 5. A piece of braſs was hardened by beating it between two large flints, uſing one for the hammer and the other for the anvil; but ſtill it acquired a magnetic property, tho' leſs than with the iron hammer, which might be explained by the roughneſs of the flints, and their not coming into contact ſufficiently with the metal. Neither of the flints was found to have acquired the ſmalleſt degree of magnetic power either before or after the experiment. 6. By melting the braſs in a crucible, it was found to have entirely loſt its magnetiſm. 7. A piece of braſs deprived of its magnetic property by fire, regained it after a few ſtrokes of the hammer, though laid between two pieces of copper. 8. Moſt of the pieces of braſs tried by our author became magnetic by hammering; but ſome, though rendered equally hard with the reſt, did not affect the needle in the leaſt; but theſe could not originally be diſtinguiſhed from ſuch as are capable of becoming magnetic. 9. As, notwithſtanding the precautions made uſe of in the above experiments to prevent the iron of the hammer from being in any manner of way communicated to the braſs, an objection might ariſe, that ſome quantity of the calx might be diffuſed through the metal, and acquire phlogiſton by hammering, he tried the following experiment, which ſeemed deciſive. A piece of braſs which would acquire no magnetiſm by hammering, was put upon an anvil with a conſiderable quantity of crocus martis, which had no effect upon the needle. It was then hammered for a long time, turning it frequently, ſo that the crocus was beat into the ſubſtance of the braſs, and gave it a red colour; nevertheleſs, it affected the needle in this ſtate no more than before. 10. A hole of about an eighth part of an inch in length, and little more than one 50th of an inch in diameter, was drilled in a piece of braſs which could not be rendered magnetic by hammering; after which the hole was filled with crocus martis, and hammered as before, but ſtill it ſhowed no ſigns of magnetiſm (A). 11. On making this piece of braſs, containing the crocus, red hot, it then affected the needle, but only in that place where the crocus was. 12. On repeating this experiment with black calx of iron inſtead of crocus martis, the braſs was weakly attracted in that place where the calx was, and this attraction was neither augmented nor diminiſhed by calcination. 13. On mixing a ſmall quantity of iron with four times its weight of braſs which could not be made magnetic by hammering, the whole was rendered powerfully magnetic; but on again mixing this compound with 50 times its weight of the ſame braſs, the attraction became ſo weak as to be ſcarcely perceptible; and was neither augmented by hammering nor diminiſhed by ſoftening. 14. On repeating moſt of his experiments, by letting the pieces of braſs float upon quickſilver in the manner hereafter deſcribed, he found that very few of them were not affected; and even the indifference of any of them did not ſeem to be

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(A) Theſe two experiments ſeem inconſiſtent with our author's aſſertion, that calces of iron are *always* affected in ſome degree by the magnet.

Subſtances attracted by the Magnet.

be very well aſcertained; though theſe did not acquire any additional magnetiſm by hammering.

From all theſe experiments Mr Cavallo draws the following concluſions. 1. Moſt braſs becomes magnetic by hammering, and loſes that property by annealing or ſoftening in the fire; or at leaſt its magnetiſm is ſo far weakened by it, as afterwards to be only diſcovered when floating on quickſilver. 2. The acquired magnetiſm is not owing to particles of iron naturally or artificially mixed with the braſs. 3. The pieces of braſs which have that property retain it without any diminution after a great number of repeated trials; but he found no method of giving magnetiſm to braſs which it had not naturally. 4. A large piece of braſs has generally a ſtronger magnetic power than a ſmall one; and the flat ſurface draws the needle more powerfully than the edge or corner. 5. If only one end of a piece of braſs be hammered, then that end alone will diſturb the magnetic needle. 6. The magnetic power which braſs acquires by hammering has a certain limit, beyond which it cannot be increaſed by farther hammering. This limit is different in different pieces of braſs, according to their thickneſs or quality. 7. In the courſe of his experiments, the following circumſtance was twice obſerved: A piece of braſs which had the property of becoming magnetic by hammering, and of loſing that property by annealing loſt its magnetic power entirely by being left in the fire till partially melted, but recovered it again on being fully ſo. 8. A long continuance in a ſtrong fire, which alters the texture of the metal, making it what ſome workmen call *rotten*, generally deſtroys the magnetic property alſo; whence this property ſeems to be owing to ſome particular configuration of its parts. 9. When braſs is uſed in magnetical inſtruments, it ought either to be left entirely ſoft, or choſen of ſuch a ſort as will not become magnetic by hammering. 10. There are few ſubſtances in nature, which, when floated upon quickſilver, are not affected in ſome degree by the magnet.

Our author next proceeded to try the magnetic power of other metals, particularly the component parts of braſs, &c. copper, and zinc. With the former the reſult was doubtful; and though pieces of hammered copper would ſometimes attract the needle, yet the attraction was always exceedingly weak. Zinc had no effect, either in its natural ſtate or hammered as much as it could bear without breaking. A mixture of it with tin had no effect. The ſame was obſerved of a piece of a broken reflector of a teleſcope made; of tin and copper; a mixture of tin, zinc, and copper; a piece of ſilver whether ſoft or hammered a piece of pure gold whether ſoft or hammered; a mixture of gold and ſilver, both hard and ſoft; and another mixture of gold and ſilver, a little copper, and a ſtill leſs quantity of gold.

The magnetic property of nickel has been mentioned by ſeveral authors; but Mr Cavallo ſays he has found ſome pieces which did not affect the needle in the leaſt. "It is probable (ſays he) that theſe pieces were not pure nickel, and perhaps ſome cobalt was contained in them; but I ſee no reaſon why the nickel, when alloyed with a little cobalt, ſhould ſhow no attraction towards the magnet, if that property did really and eſſentially belong to it." Our author, laſtly, made ſeveral experiments upon platina; the magnetic properties of which are found to be very ſimilar to thoſe of braſs; the native grains becoming magnetic by hammering, and loſing that property by heat; but the precipitate from aqua-regia, fuſed in a violent fire, or rather concreted together by this means, ſhowed no ſign of attraction whatever.

Attraction towards Iron.

§ 3. *Of the Attraction of the Magnet towards Iron in its various States of Exiſtence.*

I. The firſt experiment which naturally occurs on this ſubject is, Whether mere heat can make any change in the magnetic properties of iron without deſtroying its texture or diminiſhing the power of the magnet to which it is applied. Kircher ſays, that he tried this experiment, and found that a piece of iron heated to ſuch a degree as to be ſcarcely diſcernible from a burning coal, was in that ſtate as powerfully attracted as if it had been cold. Mr Cavallo found the effect directly the reverſe; for, having heated a piece of ſteel red hot, and in that ſtate preſented it to the magnet, ſo as to touch it repeatedly in various places, not the leaſt ſign of attraction could be perceived. In this experiment, the redneſs of the iron could plainly be perceived in day-light; and our author acknowledges, that iron, tho' its redneſs be perceptible in the dark, will ſtill be attracted by the magnet. The reſult was the ſame on repeating the experiment a number of times over; but the attraction became as ſtrong as ever a little after the redneſs ceaſed in the dark. The attraction ſeemed to begin ſooner in ſteel than in iron. Our author does not pretend to ſay, that by heating iron to a red, or even to a white heat, the attraction of the magnet for it is abſolutely annihilated; but it certainly was ſo far diminiſhed that it did not affect the magnetic needle.

II. It was now tried what would be the effect of decompoſing iron; and with this view an earthen veſſel, containing about two ounces of iron-filings, was placed near the ſouth end of the needle of the compaſs, by which the latter was drawn a little out of its direction. On adding ſome water, and then vitriolic acid, the attraction ſeemed to be increaſed, and the needle came nearer the veſſel. This ſuperior attraction continued till the efferveſcence began to ceaſe; and at laſt it was found to be inferior to what it had been originally. To obviate ſome objections which might ariſe from the motion of the iron-filings, the experiment was repeated with ſteel-wire twiſted in various directions, ſo as to preſent a large ſurface to the acid; and being placed at a proper diſtance from the needle, it attracted it out of its direction from 281° to 280°. After adding the diluted vitriolic acid, a ſtrong efferveſcence enſued, and the needle was moved to 279° 47′; five minutes after that it ſtood at 279° 35′; and in five minutes more at 279° 30′; ſeeming even to come ſomewhat nearer in a little time after: but as it then appeared to have gained its maximum of attraction, the pot was removed, and the needle went back to its original ſtation of 281°.

On repeating this experiment with different acids, it was found that the vitriolic increaſed the attraction more than either the nitrous or marine. With the former of theſe the maximum of attraction was ſooner gained

gained and ſooner loſt than with the reſt; and with marine acid the attraction was weakeſt of all; which, however, our author imputes to his not being able to raiſe a ſufficient effervefcence with this acid.

III. The degree of magnetic attraction depends upon the ſtrength of the magnet itſelf, the weight and ſhape of the iron preſented to it, the magnetic or unmagnetic ſtate of the body, and the diſtance between them. A piece of clean and ſoft iron is more powerfully attracted than any other ferruginous ſubſtance of the ſame ſize and ſhape. Steel is attracted leſs powerfully. The attraction is ſtrongeſt at the poles, diminiſhing according to the diſtance from them, and entirely ceaſing at the equator or middle point betwixt the poles. It is ſtrongeſt near the ſurface of the magnet, diminiſhing as we recede from it; but the proportion in which this diminution takes place has not been exactly determined. M. Muſchenbroeck made the following experiments in order to determine this point.

1. A cylindrical magnet, two inches long, and weighing 16 drams, was ſuſpended by an accurate balance above a cylinder of iron exactly of the ſame ſhape and dimenſions, and the degree of attraction betwixt the two meaſured by weights put into the oppoſite ſcale; the magnet being ſucceſſively placed at different diſtances from the iron. The reſults were as follow:

Diſtance in inches.	Attraction in grains.
6	3
5	3¼
4	4½
3	6
2	9
1	18
0	57

2. A ſpherical magnet of the ſame diameter with the cylindrical one, but of greater ſtrength, was affixed to one of the ſcales of the balance, and the cylindrical magnet uſed in the former experiment placed upon the table with its ſouth pole upwards, facing the north pole of the ſpherical magnet; when the attractions were found as follow:

Diſtance in inches.	Attraction in grains.
6	21
5	27
4	34
3	44
2	64
1	100
0	260

3. Changing the cylindrical magnet for the iron cylinder abovementioned, the reſult was as follows:

Diſtance in inches.	Attraction in grains.
6	7
5	9½
4	15
3	25
2	45
1	92
0	340

IV. Uſing a globe of iron of the ſame diameter with the magnet inſtead of the cylinder, the reſults were:

Diſtance in inches.	Attraction in grains.
8	1
7	2
6	3¼
5	6
4	9
3	16
2	20
1	64
0	290

In the experiments with the cylinder, it was found that the magnet attracted a ſhorter cylinder with leſs force, but in the ſame proportion.—From the others, it appears, that one magnet attracts another with leſs force than a piece of iron, but that the attraction begins from a greater diſtance; whence it muſt follow a different law of decreaſe.

IV. The attraction between the magnet and a piece of iron is ſubject to variation from the mere ſhape of the latter, their being a limit in the weight and ſhape of the iron, in which it will attract it more forcibly than any other; but this can only be determined by actual experiment.

V. It has already been obſerved, that magnetic attraction takes place only between the oppoſite poles of two magnets: however, it frequently happens, that though the north pole of one magnet be preſented to the north pole of another, that they ſhow neither attraction nor repulſion; but that when placed very near each other, they will attract. This is explained by our author in the following manner; "When a piece of iron, or any other ſubſtance that contains iron, is brought within a certain diſtance of a magnet, it becomes itſelf a magnet, having the poles, the attractive power, and, in ſhort, every property of a real magnet. That part of it which is neareſt to the magnet acquires a contrary polarity; but it often happens that one of the magnets, being more powerful than the other, will change the pole of that other magnet in the ſame manner as it gives magnetiſm to any other piece of iron which is expoſed to its influence; and then an attraction will take place between two poles apparently of the ſame names; though, in fact, it is an attraction between poles of different names, becauſe one of them has actually been changed. Thus, ſuppoſe that a powerful magnet has been placed with its north pole very near the north pole of a weak magnet, it will be found, that, inſtead of repelling, they will attract each other, becauſe that part of the weak magnet which before was a north pole, has been changed into a ſouth pole by the attraction of the ſtrong magnet."

VI. Neither the attraction nor the repulſion of magnetiſm is ſenſibly affected by the interpoſition of bodies of any ſort, excepting iron or ferruginous ſubſtances in general. Thus ſuppoſe that when a magnet is placed at an inch diſtance from a piece of iron, an ounce, or any determinate weight, is required to move it; the ſame will be required, though a plate of metal,

metal, glaſs, or any other ſubſtance excepting iron be interpoſed. Neither the abſence nor preſence of air has any effect upon it.

VII. By heat, the power of a magnet is weakened; and when it arrives at that degree called a white heat, it is entirely deſtroyed. On the other hand, the attraction is increaſed conſiderably by adding more and more weight to the magnet: for thus it will be found that the magnet will keep ſuſpended this day a little more weight than it did the day before; which additional weight being added to it on the following day, or ſome day after, it will be able to ſuſpend a weight ſtill greater, and ſo on as far as a certain limit. On the other hand, by an improper ſituation, or by diminiſhing the quantity of iron appended to it, the power will decreaſe very conſiderably.

VIII. The magnetic attraction is communicable to any given piece of ſteel only in a certain degree; and therefore if a magnet is ſtrong enough to give the maximum of attraction to the piece, it cannot be afterwards rendered more powerful by applying another magnet, however ſtrong. Thus, indeed the ſteel may be made ſtronger for a few minutes; but this overplus of attraction begins to go off as ſoon as the ſtrong magnet is withdrawn; and the power, continuing gradually to diminiſh, ſettles in a ſhort time at that degree which is its limits ever after.

IX. Some have aſſerted, that in the ſouthern parts of the world, the north pole of the magnet is ſtronger than the ſouth pole, and that in the northern parts the contrary takes place; others are of a quite contrary opinion, affirming, that in the northern regions the ſouth pole is ſtronger than the north one: but neither of theſe opinions have yet been ſufficiently confirmed by experience.

X. If a piece of iron be held to one of the poles of a magnet, the attractive power of the other pole will thus be augmented: Hence we may underſtand why a magnet will lift a greater weight from a piece of iron than from wood or any other ſubſtance, viz. that the iron appended to the magnet becomes itſelf a magnet while it remains in that ſituation; and thus, having two poles, the iron which is placed near the one increaſes the attractive power of the other which adheres to the magnet, and enables it to ſuſtain a greater weight than it would otherwiſe do.

XI. Soft iron acquires the magnetic power by being appended to a magnet; but it laſts only while the iron remains in that ſituation, vaniſhing as ſoon as the magnet and iron are ſeparated from each other. With hard iron, but eſpecially ſteel, the caſe is quite different; and the harder the iron or ſteel is, the more permanent is the magnetiſm which it acquires; though in proportion to this ſame hardneſs it is difficult to impregnate it with the virtue.

XII. The ſmalleſt natural magnets generally poſſeſs the greateſt proportion of attractive power; ſo that there have frequently been ſeen magnets not weighing more than 20 or 30 grains, which would take up 40 or 50 times their own weight; but the greateſt proportion of attractive power, perhaps ever known, belonged to the magnet worn by Sir Iſaac Newton in his ring. It weighed only three grains, and was able to take up 746 grains, or nearly 250 times its own weight; and Mr Cavallo has ſeen one which could not weigh more than ſix or ſeven grains, and yet was capable of lifting 300. A ſemicircular ſteel magnet made by Mr Canton, weighing an ounce and 13 penny-weights, took up 90 ounces; but magnets of about two pounds ſeldom lift more than five or ſix times their own weight, or indeed ſeldom ſo much. It frequently happens, that a piece cut off from a large natural magnet will lift more than the ſtone itſelf did when whole; which is to be attributed to the heterogeneous nature of the ſtone itſelf; for if part of it be impure, it is plain that this can do nothing elſe than obſtruct the virtue of the remainder, which conſequently muſt act more powerfully when the obſtruction is removed.

13. As the two magnetic poles taken together are capable of lifting a much greater weight than a ſingle one, and as they are generally ſituated in oppoſite parts of its ſurface, it has been cuſtomary to adapt two broad pieces of ſoft iron to them, letting the pieces project on one ſide of the magnet; becauſe, in that caſe, the pieces themſelves being rendered magnetic, another piece of iron could be conveniently adapted to their projections ſo as to let both poles act in concert. Theſe pieces of iron are generally held faſt upon the magnet by means of a braſs or ſilver box; in which caſe the magnet is ſaid to be *armed*, and the pieces of iron are called its *armature*. For the ſame purpoſe, and to avoid the armature, artificial magnets have been commonly made in the ſhape of a horſe-ſhoe, having their poles in the two extremities. This is by far the beſt ſhape for magnets; and the horſe-ſhoe ones are always more powerful than ſtraight magnetic bars.

§ 4. *Of the Polarity of the Magnet.*

Though, properly ſpeaking, no magnet can have more than two poles, viz. a north and a ſouth one, yet it frequently happens that both the natural and artificial kind are divided as it were into ſeveral magnets; each of which having likewiſe a north and ſouth pole, the whole appears to have a number of poles, ſome of one denomination and ſome of the other.—This plurality of poles ariſes ſometimes from the ſhape, but more commonly from the heterogeneous nature, of the magnet itſelf: and with reſpect to thoſe which have more than two poles, the following laws have been obſerved: 1. That the parts adjacent to one pole are endowed with a contrary polarity. 2. That the poles of one denomination are not always equal in number, but that they never differ by more than one: thus if the magnet has four ſouth poles, it will either have three, four, or five north poles. Good and properly ſhaped magnets, however, have only two poles directly oppoſite to one another; though in truth it is always one half, or at leaſt a great part of the magnet, that poſſeſs one kind of polarity, the other having the contrary kind; the two points, which we call the *poles*, being only thoſe where the attractive virtue is ſtrongeſt. Thoſe two points, in good magnets, are joined by a line paſſing through the centre, which line is called the *axis* of the magnet; and a circle whoſe plane is perpendicular to the axis encompaſſing the middle of the magnet is called its *equator*; and to complete the ſuppoſed ſimilarity between the terraqueous globe and magnetical bodies, the latter have frequently

quently been formed of a ſpherical ſhape, with the poles and equator marked upon their ſurface; in which caſe they have got the name of *terrellas* or ſmall earths. On breaking a magnet into two or three parts, each one becomes a perfect magnet, though they have not always an equal number of poles of the ſame denomination. The poles of the broken pieces generally anſwer to thoſe of the whole magnet which were neareſt them, though this does not always hold good.

A magnet with two poles will very readily place itſelf in the magnetic meridian, if ſuſpended by a fine thread, or otherwiſe left at liberty to turn; but when there are more than two poles, it may happen that their oppoſite tendencies will counteract each other in ſuch a manner that the magnet cannot traverſe; though it will ſtill attract and repel as though it had only two. Thus, ſuppoſe that an oblong magnet has a north polarity at both ends and a ſouth polarity in the middle; if the north poles are both equally ſtrong; then it is plain, that neither of them can point towards that quarter in preference to the other; but if a magnet of this kind be broken in the middle, the two parts will traverſe very readily. It very ſeldom happens, however, that both poles are equally ſtrong; in which caſe one of them will always get the better of the other, and the magnet will traverſe notwithſtanding its having more than two poles. The polarity of the magnet is its moſt valuable property, as upon it depends the conſtruction of the magnetic needle or mariner's compaſs ſo uſeful in navigation; for an account of which, ſee the article COMPASS, and NEEDLE.

For the variation of the needle, or its declination from the true north and ſouth direction, ſee the article VARIATION.

An account of the inclination or dipping of the magnetic needle is given under the article *Dipping Needle*.

The directive, or polar power of a magnet, extends farther than its attractive power: thus if a magnet freely ſuſpended, be placed in the neighbourhood of another, it will be found that they can effect each other's direction when their attraction towards iron or towards each other cannot be perceived. This may be eaſily tried by placing one of them in a ſcale of a balance and the other at the diſtance below it.

CHAP. II. *Theory of Magnetiſm.*

The phenomena of magnetiſm, like thoſe of electricity depend on a cauſe ſo little ſubject to the inveſtigation of our ſenſes, that any regular and well ſupported theory can as yet ſcarcely be expected. The ſubject indeed is ſtill more difficult than that of electricity; for in the latter the fluid is often made viſible and otherwiſe perceptible by our ſenſes; but no experiment could ever render the cauſe of magnetiſm perceptible otherwiſe than by its effects. The idea of its being occaſioned by a fluid entering in at one pole and paſſing out at another, took its riſe, and became pretty general, from the following experiment: Having put a ſmall artificial magnet among ſome iron-filings laid upon a piece of paper, give the table a few gentle knocks with your hand, ſo as to ſhake the filings a little, and they will diſpoſe of themſelves as repreſented in fig. 1. where A B and C D repreſent the two poles of the magnet, and the dotted lines the diſpoſition of the filings. But Mr Cavallo obſerves, that this experiment cannot be any proof of the fluid's circulation; "becauſe if the fluid, of whatever nature it may be, did really circulate from one pole to the other, and had any action on the filings, theſe would be all driven towards that pole to which the fluid directed its courſe. The true cauſe of the diſpoſition of the filings is their becoming actually magnetic, and their two extremities being poſſeſſed of contrary polarities. Now, when there are many particles of iron near the magnet, thoſe which touch its ſurface are rendered magnetic; conſequently they attract other particles, and theſe being alſo rendered magnetic, attract others, and ſo on, forming ſtrings of ſmall magnets, which gradually increaſe in power as they recede from the magnet. As each of theſe particles has two magnetic poles, by a little conſideration it will appear, that the fartheſt ends of theſe ſtrings or lines which proceed from the parts adjacent to one of the poles of the magnet, for inſtance the north are likewiſe poſſeſſed of the north polarity; and the fartheſt extremities of thoſe which proceed from the parts adjacent to the ſouth pole of the magnet, are poſſeſſed of the ſouth polarity: hence, when they come ſufficiently near, they attract the extremities of the former ſtrings, and conſequently form the curves delineated on the figure. The ſhaking of the table in this experiment ſerves to ſtir the filings, by making them jump up a little way, and thus place themſelves in the proper ſituation; otherwiſe the action of the magnet will not have power ſufficient to diſpoſe properly thoſe particles which ſtand at a conſiderable diſtance.

Plate CCLXXVI. fig. 1.

The late diſcoveries in electricity have naturally ſuggeſted another theory, viz. that the magnetic phenomena may be occaſioned by a fluid analogous to the electric, or perhaps by the very ſame: and with a view to inveſtigate this theory, the phenomena of magnetiſm and electricity have been accurately compared with each other, and the analogy between them carefully marked. This analogy is found to conſiſt principally in the following particulars:

1. Electricity is of two kinds, poſitive and negative, each of which repels its own kind, and attracts the oppoſite. In magnetics, the north and ſouth poles do the ſame; each being repulſive of its own kind of magnetiſm, and attracting the oppoſite.

2. In electricity, whenever a body in its natural ſtate is brought near an electrified one, it becomes itſelf electrified, and poſſeſſed of the contrary electricity; after which an attraction takes place. In like manner, when a piece of iron or ſteel is brought within the influence of a magnet, it becomes itſelf poſſeſſed of a magnetiſm contrary to that which the magnet poſſeſſes, and is of courſe attracted.

3. One ſort of electricity cannot be produced without the other, nether is it poſſible to produce one kind of magnetiſm without the other alſo.

4. The electric power may be retained by certain ſubſtances, as amber, glaſs, &c. but eaſily pervades other ſubſtances, which are therefore called *conductors*. Magnetiſm has a ſimilar conductor in ſoft iron; for by means of it the virtue may be extended farther

than can be done without it; at the ſame time that the iron itſelf loſes all magnetic power the moment it is ſeparated from the magnet. Hardened iron, caſt-iron, and ſteel, perform a part analogous to that of electrics; for the virtue does not eaſily pervade them, but is retained, and may be communicated by them to other unmagnetic pieces, in like manner as the electric virtue may be communicated to bodies by means of an excited electric. With regard to other ſubſtances, they ſeem not to be properly conductors of magnetiſm, becauſe the fluid pervades them as though nothing were preſent, and they cannot tranſmit the virtue farther than it would go without them. With ſoft iron it is otherwiſe. Thus, if to one of the poles of a magnet we append a piece of iron of conſiderable length, the end fartheſt from the magnet will likewiſe attract iron with much more force than the magnet could do at that diſtance without it, while at the ſame time this attractive power is plainly that of the magnet itſelf, and not any way inherent in the iron, as it vaniſhes the moment we ſeparate them. If a piece of hard ſteel of an equal length with the iron be appended to the magnet by one of its ends, we will find that the diſtant end will not manifeſt any attraction, and it will be a conſiderable time before the magnetic virtue can diffuſe itſelf for any diſtance along it; but when the ſeparation is made, the ſteel will be found to be magnetic, and will preſerve its virtue for a long time.

5. The electric virtue exerts itſelf moſt powerfully on points, which are found to carry it off or receive it in vaſt quantities. In like manner a magnet will hold a piece of iron more powerfully by a corner, or blunt point, than by a flat ſurface. On ſharp points indeed the magnet has but little hold by reaſon of the deficiency of ſurface.

6. From ſome experiments related under the article Electricity, it appears poſſible to ſuperinduce the negative and poſitive electricities upon one another; and in magnetics it is poſſible to do the ſame. Thus, if we place a wire of ſome length upon a pivot, ſo that it can turn very eaſily, by touching both ends of it upon the poles of a magnet it will acquire a polarity; one end being repelled by one pole and attracted by the other. If now we give the north end, for inſtance, a very ſlight touch with the north pole of the magnet, we will find that it has a ſmall degree of ſouth magnetiſm ſuperinduced upon it, ſo that on approaching the ſouth pole of the magnet it will be repelled; but by approaching the magnet nearer, or holding the wire for a little from flying away, the ſouth magnetiſm of the wire will be entirely deſtroyed, and the north magnetiſm appear as before. This experiment is not very eaſily made; its ſucceſs depends on having the firſt magnetiſm as ſtrong and the ſecond as weak as poſſible.

Theſe are the moſt remarkable particulars in which magnetiſm and electricity are found to agree; but the differences between them are no leſs remarkable than thoſe particulars. The magnetic power affects none of our ſenſes, and moſt perceptibly at leaſt attracts only iron; while electricity attracts and repels bodies of every kind indiſcriminately. The electric virtue reſides on the ſurface, but that of the magnet pervades the whole ſubſtance. A magnet loſes nothing of its power by communicating its virtue to other bodies, but electricity always does: and, laſtly, the magnetic virtue is permanent; whereas that of electricity, without the greateſt care, is exceedingly periſhable, and capable of being diſſipated.

Notwithſtanding theſe diſagreements, however, the analogies betwixt magnetiſm and electricity are ſo great, that the hypotheſis of a magnetic as well as of an electric fluid has now gained general credit; and upon this hypotheſis Profeſſor Æpinus has attempted to ſolve the phenomena of magnetiſm in the following manner:

1. This fluid is ſufficiently ſubtile to penetrate the ſubſtance of all terreſtrial bodies, and like the electric fluid is ſuppoſed to be repulſive of itſelf.

2. There is a mutual attraction between the magnetic fluid and iron, but an indifference betwixt it and all other bodies.

3. There is a great reſemblance betwixt ferruginous bodies and electrics, as the magnetic fluid paſſes with difficulty through the former.

4. Iron and all ferruginous ſubſtances contain a quantity of magnetic fluid equably diſperſed through their ſubſtance when thoſe bodies are not magnetic. In this ſtate they ſhow neither attraction nor repulſion, becauſe the repulſion between the particles of magnetic fluid is balanced by the attraction between the matter of thoſe bodies and the fluid; in which caſe theſe bodies are ſaid to be in a natural ſtate: but when in a ferruginous body the quantity of magnetic fluid is driven to one, then the body becomes magnetic; one extremity of it being now overcharged with magnetic fluid and the other undercharged. Bodies thus conſtituted, [viz. rendered magnetic, exert a repulſion between their overcharged extremities in virtue of the repulſion between the particles of that exceſs of magnetic fluid, which is more than overbalanced by the attraction of their matter. There is an attraction exerted between the overcharged extremity of one magnetic body and the undercharged extremity of the other, on account of the attraction between that fluid and the matter of the body: but to explain the repulſion which takes place betwixt their undercharged extremities, we muſt either imagine that iron when deprived of the magnetic fluid is repulſive of itſelf, or that the undercharged extremities appear to repel each other only becauſe either of them attracts the oppoſite overcharged extremities.

A ferruginous body, therefore, according to this hypotheſis, is rendered magnetic by having the equable diffuſion of magnetic fluid through its ſubſtance diſturbed, ſo as to have an overplus of it in one or more parts and a deficiency in others, its magnetiſm remaining as long as its impermeability prevents the reſtoration of the balance between the overcharged and undercharged parts. A piece of iron is rendered magnetic by the vicinity of a magnet; becauſe when the overcharged part or pole of the magnet is preſented to it, the overplus of the magnetic fluid in that pole repels the fluid away from the neareſt extremity of the iron; which therefore becomes undercharged, or poſſeſſed of the contrary polarity, to the moſt remote part of the iron, which conſequently becomes overcharged, or poſſeſſed of the ſame polarity as the preſented pole of the magnet. When the piece of iron is rendered magnetic by preſenting it to the undercharged extremity or pole of the magnet, then the part of the iron which is neareſt to it becomes overcharged, &c. becauſe that part of the magnet, being deprived of its magnetic fluid, attracts the magnetic fluid of the iron to that extremity of the iron which lies neareſt to itſelf.

Hence, in order to give magnetiſm to a piece of ſteel, the ſtrength of the magnet employed muſt be ſuch as to overcome the reſiſtance which the ſubſtance of the ſteel makes againſt the free paſſage of the magnetic fluid: hence a piece of ſoft ſteel is rendered magnetic more eaſily than a hard one, and a ſtrong magnet will render magnetic ſuch bodies as a weak one cannot affect. When two magnets of equal power have their oppoſite poles preſented to each other, they mutually preſerve and ſtrengthen the powers of each other; but when poles of the ſame denomination are forced together, if the powers are equal, they mutually weaken each other; or if unequal, the weaker will have its poles altered, or perhaps its attractive power entirely deſtroyed in a ſhort time.

Before we make any remarks upon this hypotheſis, it will be neceſſary to take notice of another, which Mr Cavallo conſiders as ſo well eſtabliſhed, "that there can hardly be a philoſopher ſceptical enough to doubt of its truth." This is that the earth itſelf is a magnet; which poſition he ſays is proved almoſt to a demonſtration in the following manner

1. Almoſt all the phenomena which may be exhibited with a common magnet may alſo be exhibited with the earth, as far as it can be tried. And,

2. Vaſt maſſes of iron or ferruginious matter actually magnetic are dug out of the earth almoſt in every part of it.

In ſupport of the above poſition, he adduces the phenomena of the compaſs, dipping-needle, and the magnetiſm (to be afterwards explained) which ſoft iron receives when properly ſituated. All theſe may be imitated by a common magnet or terrella. An objection, however, occurs, that the moſt remarkable phenomenon of all, viz. the attraction of iron, is wanting. No experiment has yet ſhown that this metal is attracted more powerfully near the poles than at the equator itſelf; yet this ought very notably to be the caſe in ſuch a large magnetic body. Our author indeed is of opinion, that if the experiment were tried with ſufficient accuracy, the weight of the iron would be augmented by proceeding a conſiderable way either ſouthward or northward. But beſides that this hypotheſis is as yet entirely unſupported by experiment, the difference he even ſuppoſes is quite trifling and inſignificant. The dipping of the needle may indeed ſhow that in this hemiſphere there is a ſuperiority of attraction between one end of the needle and the earth: but it remains to be proved whether this ſuperiority reſides in the needle or in the earth itſelf. The following conſideration indeed ſeems evidently to ſhow that the power, whatever it is, reſides in the needle itſelf; namely, that at the equator, the needle ought to remain in an eaſt and weſt direction, if ſo placed; becauſe of the equal attraction of the north and ſouth poles. Were the needle carried to the pole itſelf, we can only ſuppoſe that it would point perpendicularly downwards; in every other caſe, the attraction will not be perpendicular; but oblique: and ſuppoſing us to recede from the point of perpendicular attraction only a few miles, the obliquity would become ſo great, that no attraction or repulſion towards that point would be diſtinguiſhable from an horizontal direction. The inclination of the needle therefore ſhows, that it is not actuated by the influence of a diſtant point in the earth; but by ſome power in the atmoſphere immediately acting upon the needle, and directing its courſe either to the earth, or from it, in a certain poſition.

Thoſe who maintain the magnetiſm of the earth, have been conſiderably embarraſſed with ſome of the natural phenomena. The variation of the compaſs firſt ſhowed that the needle was not influenced by thoſe points on which the earth turns round in its diurnal courſe; but this was eaſily ſolved by another hypotheſis, viz. that the earth had two magnetical poles by which the needle is influenced, and two others round which it turns on its axis. This hypotheſis was likewiſe embarraſſed by the continual ſhifting of the variation either to the eaſtward or weſtward. Hence another ſuppoſition was made by Dr Halley; namely, that there is a large magnet incloſed within the body of the earth, which not being fixed to the external part moved with reſpect to it, and of conſequence occaſioned the variation. This was likewiſe overthrown, by obſerving that the variation of the compaſs was irregular, and differed ſo much in different parts of the world, that it could not be owing to any regular cauſe diffuſed over the whole. Four magnetic poles were then ſuppoſed to lie within the earth, and to be moveable with reſpect to each other; and that therefore the variation, whoſe theory would now be very intricate, ought to be derived from all their actions conjointly: but notwithſtanding all this complication of poles, it might ſtill be objected, that ſome kind of regularity, not obſerved in the variation of the magnetic compaſs, ought to have taken place. So that as yet there is no theory which ſeems to explain the variation with any kind of certainty.

The different hypotheſis on this ſubject are more fully conſidered under the article VARIATION: here we ſhall only obſerve, that with reſpect to the magnetiſm of the earth, the particulars already related ſeem to decide againſt its exiſtence. The moſt unequivocal proof we have of the exiſtence of magnetiſm is the attraction of iron; and this capital mark is deficient, or at leaſt has never been proved, in the earth. The poles of all the magnets, we know, are fixed and invariable; nor are we obliged to have recourſe to magnets within magnets, or other uncouth ſuppoſitions, to account for their phenomena: if the earth is a magnet, therefore, the magnetiſm it poſſeſſes muſt be of a kind ſo different from the property uſually diſtinguiſhed by that name, that we can in no reſpect determine them to be the ſame.

Mr Cavallo is of opinion that "the magnetiſm of the earth ariſes from the magnetiſm of all the magnetic ſubſtances contained in it, and intermixed with other bodies; that the magnetic poles of the earth may be conſidered as the centres of the polarities of all the particular aggregates of the magnetic ſubſtances; and that thoſe principal poles muſt change place relatively to the ſurface of the earth, according as the particular aggregates of magnetic ſubſtances within the earth are in ſome manner or other altered, ſo as to have their power diminiſhed, increaſed, approached, or removed from the principal poles." But this ſeems not by any means ſufficient to account for the phenomena. The magnetic needle is indeed affected by iron at a diſtance, but that diſtance is by no means conſiderable. A magnet or needle in a houſe in one ſtreet will not be affected by a ſmith's ſhop or iron warehouſe in another; and there is an undoubted certainty that the magnetic needle is affected on ſome parts of the ſea where no magnetic bodies can be preſent unleſs at a great diſtance on land, or below the unfathomable depths of the ocean. Beſides, let us imagine as many of theſe bodies as we pleaſe within the ſurface of the earth, they muſt be ſuppoſed, in order to account for the phenomena of the needle, to have their poles lying all nearly the ſame way; which can by no means be proved to be the caſe; not to mention that the attraction of iron would in ſome places be very perceptible, which has never yet been experienced in any part of the world.

Laſtly, the hypotheſis of the magnetiſm of the earth ſeems to be entirely overthrown by the following curious method of giving magnetiſm inſtantaneouſly to an iron-bar. Take a bar of ſoft iron two or three feet long, and between an half and two inches thick; which deſcription is very well anſwered by ſome kitchen pokers. Place it in the magnetical line, *i. e.* the poſture aſſumed by the dipping needle; or if a needle of this kind is not at hand, place it ſtraight up in any degree of north or ſouth latitude beyond 40°, or horizontally if nearer to the equator. Preſent then a magnetic needle to various parts of the bar; and it will be found, that in this country the lower half of the bar will repel the north end of the needle, and the upper half attracts it. In ſouth latitudes the caſe will be reverſed; for the lower end will attract the north pole of the needle, and the upper end repel it. If the bar be not very ſhort, its extremities will alſo attract ſmall bits of iron, as filings, &c. On turning it upſide down, the end which repelled the north pole of the needle before will now attract it; the reaſon of which is, that in the northern hemiſphere the end which is neareſt the earth always becomes a north pole, and in the ſouthern hemiſphere a ſouth one. Now it is plain that conſidering the diſtance of both poles of the earth from the iron-rod, any kind of poſture in which we can place it muſt make a difference ſo trifling, that we cannot ſuppoſe the one to influence it more than the other. The whole phenomenon ſhows that there is in the atmoſphere a current of fluid either going into the earth, or coming out from it, which influences iron when held in the direction in which itſelf moves. That it does not influence the metal when lying horizontally, may be owing to its want of ſufficient breadth to render the effect perceptible. The earth therefore is not a magnet, but is ſurrounded by a fluid whoſe motion is productive of magnetiſm in iron; and moſt probably, though it produces this as it were accidentally, will be found to anſwer much more important purpoſes in the economy of nature. The next queſtion then is with regard to the fluid itſelf: and this, from many articles in this work, will appear to be the ſame with that of electricity. Under the article AUORA *Borealis*, EARTHQUAKE, ELECTRICITY, &c. it is ſhown, that the ſolar light, abſorbed by the equatorial regions of the earth, becomes ſubject to new laws of motion, acting in ſhort as if it were another fluid, in which ſtate we call it *electricity*, or the *electric fluid*. In this ſtate it paſſes through the ſubſtance of the earth from the equator towards the polar regions, getting out again in the vicinity of the poles, aſcending into the high atmoſpherical regions, and then returning from the equatorial parts from whence it came. On this ſuppoſition, which appears to be greatly confirmed by various natural phenomena, it is eaſy to ſee, why in the northern and ſouthern parts the direction of the currents iſſuing from the earth ſhould always become more and more perpendicular to the earth as we approach the poles, and on the contary why their direction muſt be horizontal or nearly ſo in the equatorial parts. The diſcovery of this general cauſe therefore ſeems to be the neareſt approach we can as yet make to the knowledge of the origin of magnetical phenomena. In what manner *iron* more than other metals is influenced by this fluid, or why the direction of a current of electric matter either to or from the earth, ſhould cauſe ſuch ſtrong attractions as magnetical bodies are ſometimes endowed with, we have as yet no data for underſtanding.

Æpinus's theory of an accumulation of the electric fluid in one pole, and a deficiency of it in the other, ſeems not to be tenible in any reſpect. It is impoſſible to ſhow why the mere turning of a bar upſide down ſhould accumulate the fluid, unleſs it was a gravitating one in the end next the earth; aad though we ſhould even make this extravagant ſuppoſition, it will be as difficult to account for the very ſame fluid being repelled by the earth in the ſouthern hemiſphere; for if we account the north magnetiſm an accumulation, we muſt count the ſouth one a deficiency; or if the ſouth magnetiſm is an accumulation, the oppoſite one muſt be a deficiency; and whichever ſuppoſition we adhere to, the difficulties are equally great and unſurmountable.

CHAP. III. *Practice of Magnetiſm.*

THIS conſiſts in communicating the magnetic virtue from one body to another; making artificial magnets, compaſſes, dipping-needles, &c.; and inveſtigating the various phenomena reſulting from bodies placed in different ſituations.

§ 1. *To communicate Magnetiſm by the Loadſtone.*

Magnetiſm is communicated merely by preſenting a piece of iron or ſteel to one of the poles of a magnet or loadſtone, even without touching it; though a ſtrong and permanent power cannot be given without contact, or even ſtroaking the one up the other for a number of times. In this operation, that part of the ferruginous body which touches the pole of the magnet acquires the contrary magnetiſm; that is, if it touches the north pole, it will turn towards the ſouth, *et vice verſa*. The power acquired is ſtrongeſt when ſoft iron is applied, weaker with hardenened iron, and weakeſt of all with hard ſteel: but the permanency of it follows juſt the reverſe of this rule; for ſteel or hardened iron will preſerve its virtue for many years, but ſoft iron loſes it the moment we withdraw the magnet. When we deſire a ſtrong and permanent virtue, therefore, it is beſt to uſe the hardeſt ſteel, and to impregnate it by means of one or more powerful

erful magnets; taking care that the north pole of the magnet which gives the virtue be applied to that end of the ſteel which is to be made the ſouth pole. The ſame method may be employed in rendering a weak magnet more powerful than before, or in reſtoring the virtue to one which has loſt it.

Plate CCLXVI.

The operation of communicating magnetiſm to pieces of ſteel or iron, is called *touching* them; and as this is of the utmoſt utility in navigation, for the purpoſe of giving polarity to needles, very conſiderable pains have been beſtowed upon the ſubject, in order to diſcover the methods of giving them the magnetic virtue in the moſt effectual and permanent manner.—When only one magnetic bar is to be made uſe of, one of its poles muſt be applied as repreſented fig. 2. where C D repreſents the needle or ſteel bar to be impregnated. The magnet A B is then to be drawn all along the ſurface of it, till it reaches the extremity D. The magnet being then removed, muſt be applied to the extremity C, and drawn over the needle as before. Thus the needle muſt be rubbed ſeveral times; by which means it will acquire a conſiderable degree of magnetiſm. In this method, that other extremity of the needle which the magnet touched laſt acquires the contrary magnetiſm; that is, if B be the north pole of the magnet, C will be the north pole, and D the ſouth of the needle. This method, however, is never found to be equally effectually with that in which two magnets, or both poles of one magnet, are made uſe of.

To communicate magnetiſm by means of two magnetic bars, place the bar or needle A B, fig. 3. upon a table; then ſet the two magnetic bars C D, E F, ſtraight upright upon it at a little diſtance, equal on both ſides from the middle of the bar A B, and in ſuch a manner that the ſouth pole D of one of the bars may be neareſt to that end of the bar A B which is to become the north pole, &c. Theſe two bars muſt then be ſlid gradually towards one extremity the bar, keeping them conſtantly at the ſame diſtance from each other; and when one of them, for inſtance CD, is arrived at A, then they muſt be ſlid the contrary way, till EF arrives at B; and thus the bar A B muſt be rubbed a greater or ſmaller number of times, till it will be found by trial to have acquired a conſiderable power. When the magnetic bars are powerful, and the bar A B of very good ſteel, and not very large, a dozen of ſtrokes are fully ſufficient; but when the bars are to be removed from the bar A B, care muſt be taken to bring them to the ſame ſituation where they were firſt placed; viz. at a little and equal diſtance from the middle of the bar A B, from whence they may be lifted up.

If it be required to communicate the greateſt magnetic power poſſible, we may proceed in the following manner: 1. The magnetic bars may be joined at top as in fig. 4. interpoſing a piece of wood, or any other ſubſtance excepting iron; for thus the oppoſite poles being contiguous in the upper part, ſtrengthen each other, and of conſequence the lower ones are alſo ſtrengthened. 2. The bar to be rendered magnetic may be placed between the bars of ſoft iron, as ſhown in the ſame figure. 3. The magnetic bars may be inclined the contrary way, as recommended by Mr Æpinus, making an angle of about 15 degrees with the bar A B. See fig. 5. In the ſame manner may a bar be rendered magnetic by an armed or horſe-ſhoe magnet. In any of the methods hitherto mentioned, however, the bar to be rendered magnetic muſt be ſtroked on every ſide; and to let the magnetic centre fall juſt in its middle, care muſt be taken to ſtroke one half of the bar juſt as much as the other. Whenever a ſteel bar, or, in general, any piece of ferruginous matter, is rendered magnetic by the application of two bars, or by the two poles of one magnet, the operation is called the *double touch*, but the ſingle touch when only one bar is applied.

Artificial magnets of a ſemicircular form, or ſhaped like a horſe-ſhoe, have the magnetiſm communicated to them in the ſame manner with thoſe which are ſtraight, only the magnetic bars uſed for this purpoſe muſt follow the curvature of the bar to be impregnated. Thus, ſuppoſe it is required to impregnate the crooked piece of ſteel ABC, fig. 6. lay it flat on a table, and to its extremities apply the magnets D F, E G, joining their extremities F G with the conductor or piece of ſoft iron F G. Apply then the magnetic bars H I to the middle of the piece ABC, and ſtroke it with them from end to end, following the direction of the bent ſteel, ſo that on one ſide of it the magnetic bars may ſtand as repreſented by the dotted lines L.K. When the piece of ſteel has been thus rubbed a ſufficient number of times on one ſide it is then to be turned, and rubbed in like manner on the other, until it has acquired a ſufficient degree of magnetiſm.

From conſidering that ſoft iron, or ſoft ſteel, acquires magnetiſm very eaſily, though it loſes it with equal facility, Mr Cavallo was induced to ſuppoſe, that if magnetiſm were to be communicated to a piece of hard ſteel while ſoftened by heat, and the metal were then to be hardened by pouring cold water upon it while in the act of receiving the magnetiſm, it was poſſible the virtue might be firſt communicated to them in a very high degree, and then be fixed by means of the hardening of the ſteel. To determine this matter ſix magnetic bars were placed in an oblong earthen veſſel, in ſuch a manner that the north poles of three of them migh be oppoſite to the ſouth poles of the three other, forming two parcels of bars lying in the ſame direction, and about three inches aſunder, which was nearly the length of the ſteel-bar intended to be rendered magnetic. The bar was made quite red hot, and in that ſtate was placed between the magnetic bars. Cold water was then immediately poured upon it; by which it was hardened to ſuch a degree that the file could not touch it; but though it had thus received a conſiderable degree of magnetiſm, the power was not ſuperior to what might have been communicated in the ordinary way. On repeating the experiment with ſteel-bars of different ſizes, it was found that ſhort bars receive a proportionably greater degree of power than long ones, and that becauſe the latter cannot be ſufficiently penetrated by the magnetic power when the magnets are placed at their ends; and if a number of magnets be placed along the ſides, in order to communicate a greater degree of virtue, it frequently happens that the bar acquires a number of poles. Our author is nevertheleſs of opinion, that this method is of conſiderable uſe: though by it we cannot communicate any extraordinary degree of magnetiſm, it is yet very uſeful in conſtructing large artificial magnets. For thus they will acquire a conſiderable degree of power, without any additional trouble to the workman, and may then be fully impregnated in the uſual way, which cannot be done without a great deal of labour when the operation is begun upon bars which have no virtue at all.

§ 2. *To communicate the Magnetic Virtue without any Magnet either natural or artificial.*

This may be done with a ſoft iron-bar in the manner already related, viz. by turning it in a poſition perpendicular to the ſurface of the earth, or any other excepting a line directly perpendicular to the dipping-needle. The magnetiſm thus acquired, however, is always weak, and is inſtantaneouſly loſt; while a ſteel-bar will not receive any perceptible degree of magnetiſm by this method. But if an iron-bar be made red hot, and left to cool in the magnetic line, or if it be repeatedly ſtruck with a hammer while in that line, it will acquire a ſmall degree of permanent magnetiſm; though this alſo will ſoon vaniſh by leaving the bar in an improper poſition, or by inverting and ſtriking it again. The magnetiſm laſts longer in proportion to the hardneſs of the iron: but a longer time will be required to give it the degree of virtue it is capable of receiving by this method. If an iron bar is left for a long time in the direction of the magnetic line, or even in a perpendicular poſture, it will ſometimes acquire a great degree of power. Mr Boyle makes mention of an iron-bar, ten feet long, which had acquired ſo much virtue by ſtanding in this poſture, that it exceeded a loadſtone of three pounds and an half weight, and would turn the needle at eight or ten feet diſtance. Even tongs, pokers, and other kitchen utenſils, by being often heated, and ſet to cool again in an erect poſture, are frequently obſerved to gain a magnetic virtue. Sometimes iron-bars, which were not capable of receiving permament magnetiſm on account of their ſoftneſs, have, merely by expoſure to the atmoſphere for a great length of time, acquired a conſiderable degree of power; at the ſame time it has been remarked, that theſe bars became much harder by this expoſure; the cauſe of which has not yet been diſcovered.

Iron or ſteel acquires a very perceptible degree of magnetiſm by drilling, hammering, or other methods by which they are put into violent action. The cauſe of this magnetiſm Mr Cavallo looks for in the earth itſelf, the changeable nature of the metal by heat or cold, and the vibratory motion into which its parts are accidentally put. "For the ſame reaſons (ſays he) it ſeems that magnetiſm, in certain caſes, is produced by electricity; the particulars obſerved concerning which are the following:—When the bar or needle is laid horizontally in the magnetic meridian, whichever way the ſhock of an electric jar or battery enters, the end of the needle which lies towards the north acquires the north polarity, viz. the power of turning towards the north when freely ſuſpended, the other end acquiring the ſouth polarity. If the bar before it receives the ſhock has ſome polarity, and is placed with its poles contrary to the uſual direction, then its original polarity is always diminiſhed, and ſometimes reverſed. When the needle is ſtruck ſtanding perpendicularly in this hemiſphere, the lower end becomes the north pole, even when it had ſome magnetiſm before, and receives the ſhock while ſtanding with its ſouth pole downwards. When all other circumſtances are alike, the degree of magnetiſm received ſeems to be the ſame, whether the needles are ſtruck while ſtanding horizontally in the magnetic meridian or perpendicular to the horizon. When a needle is placed in the magnetic equator, a ſhock through its length very ſeldom renders it magnetic; but if the ſhock be paſſed through its width, it acquires the virtue, the extremity which lay towards the weſt generally becoming the north pole. If a needle or bar ſtrongly magnetic or a natural magnet, be ſtruck by the electric ſhock, its power is thereby diminiſhed. When the ſhock is too ſtrong, ſo that the needle is thereby rendered conſiderably hot, it acquires either no magnetiſm at all or a very ſmall degree of it. Hence a ſtroke of lightning often renders pieces of iron or ſteel magnetic, as well as thoſe bodies which naturally contain iron, as ſome bricks, &c."

There are various methods of communicating a permanent magnetiſm to ferruginous bodies, by means of a bar rendered magnetic by the earth; of which the moſt ſimple is that deſcribed by Mr Marcel, whoſe experiments were made in the year 1726. Being employed in making ſome obſervations on the magnetic power which he found in great pieces of iron, he took a large vice weighing 90 pounds, in which he fixed a ſmall anvil weighing 12 pounds. The ſteel to which he wiſhed to give the magnetic virtue was laid upon the anvil in a north and ſouth poſition, which happened to be the diagonal of the ſquare ſurface of the latter. He then took a piece of iron an inch ſquare, and 33 inches long, weighing about eight pounds, having one end rounded and brightly poliſhed, the other being tapered. Holding then the ſteel faſt upon the anvil with one hand, he took the iron-bar in the other; and holding it perpendicularly, he rubbed the ſteel hard with the rounded part towards him from north to ſouth, always carrying the bar far enough round about to begin again at the north. Having thus given 10 or 12 ſtrokes, the ſteel was turned upſide down, and rubbed as much on the other ſide. Proceeding in this manner till it had been rubbed 400 times, the ſteel was as ſtrongly magnetic as if it had been touched by a powerful loadſtone. The place where he began to rub was always the north pole. In theſe experiments it ſometimes happened that the virtue was imparted by a few ſtrokes, nay, by a ſingle one, a ſmall needle was made to receive a very conſiderable power. Thus he imparted to two compaſs needles ſuch a degree of magnetic power, that one took up $\frac{3}{4}$ths and another a whole ounce of iron; and though theſe needles were anointed with linſeed-oil to keep them from ruſting, and a hard coat was thus formed upon them they nevertheleſs retained their virtue. Thus alſo a knife was made ſo ſtrongly magnetical, that it would take up an ounce and three quarters of iron. Four ſmall pieces of ſteel, each an inch long and $\frac{1}{12}$th of an inch broad, as thin as the ſpring of a watch, were thus impregnated with the magnetic virtue, and then joined into a ſmall artificial magnet; which at its firſt formation took up eight times its own weight of iron; and after being ſix years kept in the moſt careleſs manner, was found to have rather gained than loſt any thing of its virtue. In the courſe of his experiments, Mr Marcel found, that the end at which he began to rub was always the north pole, whatever poſition the ſteel was laid in. On rubbing a piece of ſteel from one end to the middle, and then from the other end to the middle, it acquired two north poles, one at each end, the middle being a ſouth pole. Beginning to rub from the middle towards each end, he found a north pole in the middle and a ſouth pole at each extremity.

Plate CCLVXXI

Magnetiſm may be communicated to a ſmall piece of ſoft ſteel in the following manner. Take two iron bars of about an inch ſquare, and upwards of three feet in length, keep them in the magnetical line or in a perpendicular poſture, as repreſented fig. 7. Let the piece of ſteel CB be either faſtened to the edge of a table or held by an aſſiſtant; and placing the lower extremity of the bar A B, and the upper extremity of the bar C D, on oppoſite ſides, and in the middle of the ſteel, ſtroke the latter from the middle towards its extremities, moving both bars at the ſame time. When both are arrived at the extremities of the ſteel, remove them from it, and apply them again to the middle. Do ſo for 40 or 50 times, and the ſteel will be found to have a conſiderable degree of magnetic power. Care, however, muſt be taken, in removing the bars, not to draw them along the ſurface of the ſteel, or the experiment will not ſucceed, becauſe the magnetiſm is deſtroyed by the contrary ſtrokes.

The late Dr Godwin Knight poſſeſſed a ſurpriſing ſkill in magnetiſm, being able to communicate an extraordinary degree of attractive or repulſive virtue, and to alter or reverſe the poles at pleaſure; but as he refuſed to diſcover his methods upon any terms whatever (even, as he ſaid, though he ſhould receive in return as many guineas as he could carry) theſe curious and valuable ſecrets have died with him, In the 69th volume of the Philoſophical Tranſactions however, Mr Benjamin Wilſon hath given a proceſs which at leaſt diſcovers one of the leading principles of Dr Knight's art, and may perhaps be a means of diſcovering the whole to thoſe who ſhall be leſs reſerved. The doctor's proceſs, according to Mr Wilſon, was as follows. Having provided himſelf with a great quantity of clean iron-filings, he put them into a large tub that was more than one third filled with clean water; he then, with great labour, worked the tub to and fro for many hours together, that the friction between the grains of iron by this treatment might break off ſuch ſmaller parts as would remain ſuſpended in the water for a time. The obtaining of theſe very ſmall particles in ſufficient quantity ſeemed to him to be one of the principal deſiderata in the experiment. The water being by this treatment rendered very muddy, he poured the ſame into a clean iron veſſel, leaving the filings behind; and when the water had ſtood long enough to become clear, he poured it out carefully, without diſturbing ſuch of the ſediment as ſtill remained, which now appeared reduced almoſt to impalpable powder. This powder was afterwards removed into another veſſel in order to dry it; but as he had not obtained a proper quantity thereof by this one ſtep, he was obliged to repeat the proceſs many times. Having at laſt procured enough of this very fine powder, the next thing was to a make paſte of it, and that with ſome vehicle which would contain a conſiderable quantity of the phlogiſtic principle; for this purpoſe, he had recourſe to linſeed oil in preference to all other fluids. With theſe two ingredients only he made a ſtiff paſte, and took particular care to knead it well before he moulded it into convenient ſhapes. Sometimes, while the paſte continued in its ſoft ſtate he would put the impreſſion of a ſeal upon the ſeveral pieces; one of which is in the Britiſh Muſæum. This paſte was then put upon wood, and ſometimes on tiles, in order to bake or dry it before a moderate fire at about the diſtance of a foot or thereabouts. He found that a moderate fire was moſt proper, becauſe a greater degree of heat made the compoſition frequently crack in many places. The time required for the baking or drying of this paſte was generally about five or ſix hours before it attained a ſufficient degree of hardneſs. When that was done, and the ſeveral baked pieces were become cold, he gave them their magnetic virtue in any direction he pleaſed, by placing them between the extreme ends of his large magazine of artificial magnets for a few ſeconds or more, as he ſaw occaſion. By this method the virtue they acquired was ſuch, that, when any of thoſe pieces were held between two of his beſt ten-guinea bars, with its poles purpoſely inverted, it immediately of itſelf turned about to recover its natural direction, which the force of thoſe very powerful bars was not ſufficient to conteract.

In the 66th volume of the Philoſophical Tranſactions we have the following account, From Dr Fothergill, of Dr Knight's method of imitating natural magnets, but which is by Cavallo ſuppoſed to be owowing to ſome miſtake or miſinformation. "I do not know (ſays he), that ever the doctor (Dr Knight) left behind him any deſcription of a compoſition he had made to form artificial loadſtones. I have ſeen in his poſſeſſion, and many other of his friends have likewiſe ſeen, ſuch a compoſition; which retained the magnetic virtue in a manner much more fixed than either any real loadſtone or any magnetic bar however well tempered. In the natural ones he could change the poles in an inſtant, ſo likewiſe in the hardeſt bars; but in the compoſition the poles were immoveable. He had ſeveral ſmall pieces of this compoſition which had ſtrong magnetic powers. The largeſt was about half an inch in breadth, very little longer than broad, and near a quarter of an inch thick. It was not armed, but the ends were powerfully magnetic; nor could the poles be altered, tho' it was placed between two of his largeſt bars, and they were very ſtrongly impregnated. The maſs was not very heavy, and had much the appearance of a piece of black lead, though not quite ſo ſhining. I believe he never divulged this compoſition; but I think he once told me, the baſis of it was filings of iron reduced by long continued attrition to a perfectly impalpable ſtate, and then incorporated with ſome pliant matter to give it due conſiſtence."

From theſe accounts it appears that the baſis of Dr Knight's artificial loadſtones was the black powder to which iron filings are reduced by water, and which is known among the apothecaries by the name of *Martial Æthiops*: whence Mr Cavallo gives the following receipt for imitating the natural magnets.—"Take ſome martial æthiops, or, which is more eaſily procured, reduce into very fine powder the ſcales of iron which fall from red-hot iron when hammered, and are found abundantly in ſmiths ſhops. Mix this powder with drying linſeed oil, ſo as to form it into a very ſtiff paſte, and ſhape it in a mould ſo as to give it any form you require; whether of a terrella, a human head, or any other. This done, put it into a warm place for ſome weeks, and it will dry ſo as to become very hard; then render it magnetic by the application of powerful magnets, and it will acquire a conſiderable power."

As to the method of making artificial magnets of ſteel, none has ſucceeded in it better than Mr Canton, whoſe proceſs is as follows.

Plate CCLXXVI.

Procure a dozen of bars, ſix of ſoft ſteel, each three inches long, one quarter of an inch broad, and one-twentieth of an inch thick; with two pieces of iron, each half of the length of one of the bars, but of the ſame breadth and thickneſs; alſo ſix pieces of hard ſteel, each five inches and a half long, half an inch broad, and three-twentieths of an inch thick; with two pieces of iron of half the length, but the whole breadth and thickneſs of one of the hard bars; and let all the bars be marked with a line quite round them at one end. Then take an iron poker and tongs (fig. 8.). or two bars of iron, the larger they are and the longer they have been uſed, the better; and fixing the poker upright between the knees, it to hold, near the top, one of the ſoft bars, having its marked end downwards, by a piece of ſewing ſilk, which muſt be pulled tight by the left hand, that the bar may not ſlide: then graſping the tongs with the right hand, a little below the middle, and holding them nearly in a vertical poſition, let the bar be ſtroked by the lower end from the bottom to the top, about ten times on each ſide, which will give it a magnetic power ſufficient to lift a ſmall key at the marked end: which end, if the bar was ſuſpended on a point, would turn towards the north, and is therefore called the *north pole*; and the unmarked end is, for the ſame reaſon, called the *ſouth pole*. Four of the ſoft bars being impregnated after this manner, lay the two (fig. 9.) parallel to each other, at the diſtance of one fourth of an inch, between the two pieces of iron belonging to them, a north and a ſouth pole againſt each piece of iron: then take two of the four bars already made magnetical, and place them together ſo as to make a double bar in thickneſs, the north pole of one even with the ſouth pole of the other: and the remaining two being put to theſe, one on each ſide, ſo as to have two north and two ſouth poles together; ſeparate the north from the ſouth poles at one end by a large pin, and place them perpendicularly with that end downward on the middle of one of the parallel bars, the two north poles towards its ſouth and the two ſouth poles towards its north end: ſlide them backward and forward three or four times the whole length of the bar, and removing them from the middle of this, place them on the middle of the other bar as before directed, and go over that in the ſame manner; then turn both the bars the other ſide upwards, and repeat the former operation: this being done, take the two from between the pieces of iron; and, placing the two outermoſt of the touching bars in the room, let the other two be the outermoſt of the four to touch theſe with; and this proceſs being repeated till each pair of bars have been touched three or four times over, which will give them a conſiderable magnetic power, put the half-dozen together after the manner of the four (fig. 10.), and touch them with two pair of the hard bars placed between their irons, at the diſtance of about half an inch from each other: then lay the ſoft bars aſide; and with the four hard ones let the other two be impregnated (fig. 11.), holding the touching bars apart at the lower end near two tenths of an inch; to which diſtance let them be ſeparated after they are ſet on the parallel bar and brought together again before they are taken off: this being obſerved, proceed according to the method deſcribed above, till each pair have been touched two or three times over. But as this vertical way of touching a bar will not give it quite ſo much of the magnetic virtue as it will receive, let each pair be now touched once or twice over in their parallel poſition between the irons (fig. 12.), with two of the bars held horizontally, or nearly ſo, by drawing at the ſame time the north pole of one from the middle over the ſouth end, and the ſouth of the other from the middle over the north end of a parallel bar; then bringing them to the middle again, without touching the parallel bar, give three or four of theſe horizontal ſtrokes to each ſide. The horizontal touch, after the vertical, will make the bars as ſtrong as they poſſibly can be made, as appears by their not receiving any additional ſtrength, when the vertical touch is given by a great number of bars, and the horizontal by thoſe of a ſuperior magnetic power. The whole proceſs may be gone through in about half an hour; and each of the large bars, if well hardened, may be made to lift 28 Troy ounces, and ſometimes more. And when theſe bars are thus impregnated, they will give to an hard bar of the ſame ſize its full virtue in leſs than two minutes; and therefore will anſwer all the purpoſes of magnetiſm in navigation and experimental philoſophy much better than the loadſtone, which is known not to have a ſufficient power to impregnate hard bars. The half dozen being put into a caſe (fig. 13.) in ſuch a manner as that two poles of the ſame denomination may not be together, and their irons with them as one bar, they will retain the virtues they have received; but if their power ſhould, by making experiments, be ever ſo far impaired, it may be reſtored without any foreign aſſiſtance in a few minutes. And if, out of curioſity, a much larger ſet of bars ſhould be required, theſe will communicate to them a ſufficient power to proceed with; and they may, in a ſhort time, by the ſame method, be brought to their full ſtrength.

To expedite the proceſs of making magnets, the bars ſhould be fixed in a groove, or between braſs pins, to prevent them from ſliding; or they may be kept ſteady by means of a weight and ruler, as in fig. 11.

§ 3. *Apparatus for making Experiments in Magnetiſm, with an Account of various Experiments tending to illuſtrate and prove the Laws already laid down.*

The apparatus neceſſary in magnets is but ſmall, conſiſting only of a few magnets or magnetic bars, a magnetic horizontal needle or compaſs, and a dipping needle. For thoſe who do not intend to be very accurate, a common artificial horſe-ſhoe magnet and a few ſewing needles may be ſufficient; but where greater accuracy is required, it will then be neceſſary to have

Fig. 1

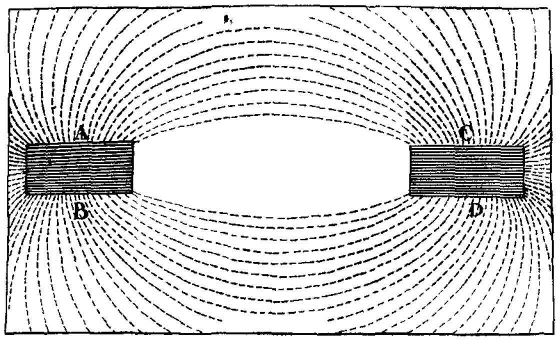


Fig. 2

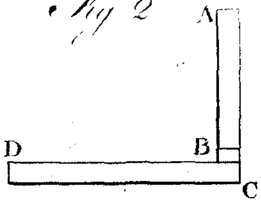


Fig. 3

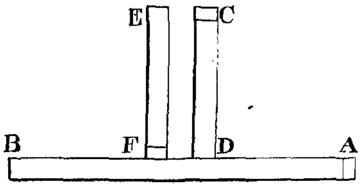


Fig. 8

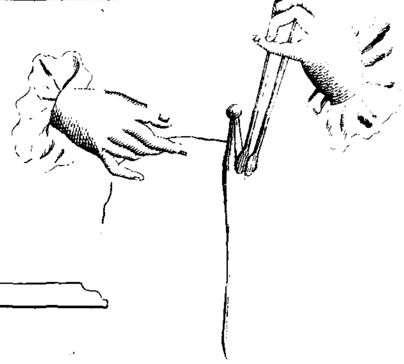


Fig. 4

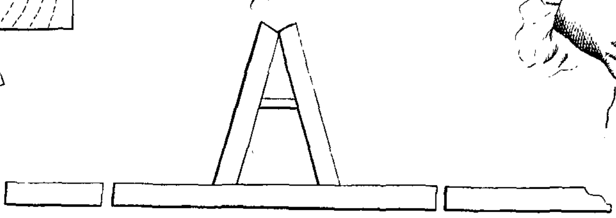


Fig. 6

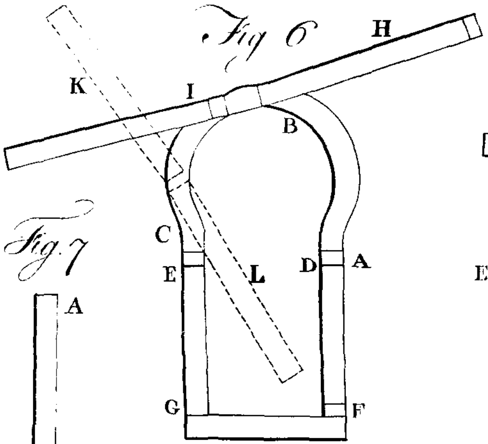


Fig. 7

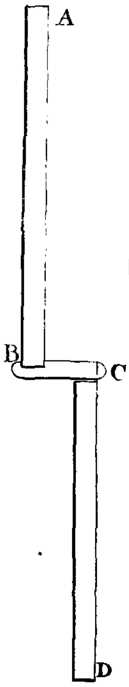


Fig. 5

Fig. 10

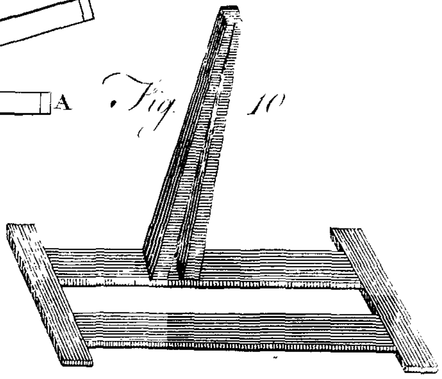


Fig. 9

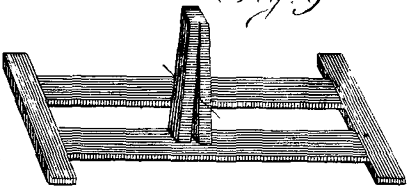


Fig. 13

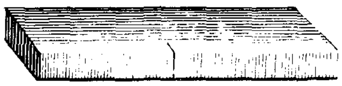


Fig. 12

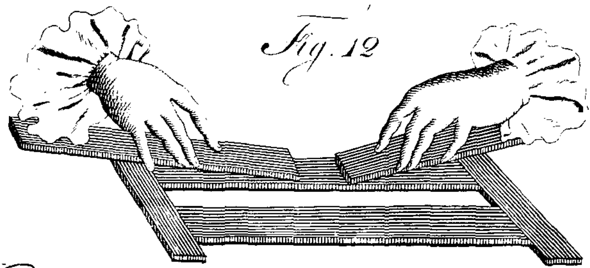


Fig. 11

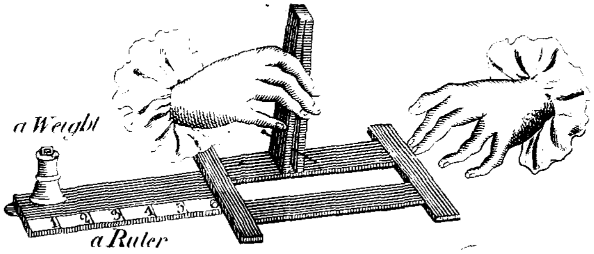


Fig. 14

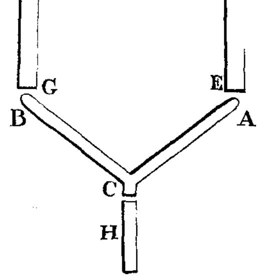


Fig. 16

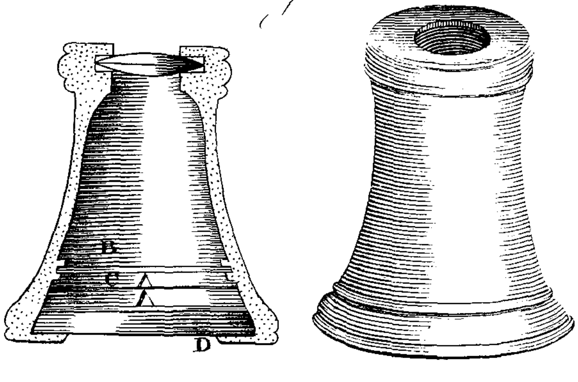
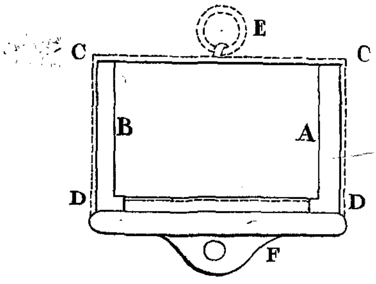


Fig. 15



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have a good ſet of magnetic bars, commonly ſix; a few ſmall magnetic needles, a larger needle in a box with a graduated circle, and a dipping needle; to which may be added ſome pieces of ſteel-wire, a few bars of ſoft iron, &c.

The magnetic bars ought to be made of the beſt ſteel, and tempered quite hard. There is not, however, any method known as yet by which we can diſtinguiſh the kind of ſteel which is beſt for magnetical purpoſes. It will be proper, therefore previous to the conſtruction of the bars, to try the quality of the metal in the following manner: Take a piece of it about three inches long and a quarter of an inch thick, no matter whether round or ſquare; make it red-hot, and in that condition plunge it into cold water, which hardens it ſo that a file will not touch it. Apply then two powerful magnetic bars; holding the north pole of one to one extremity of the ſteel, and the ſouth pole of the other magnet to the other extremity of the ſteel. Having kept them in this poſition for about a minute, ſeparate them from the ſteel, and then try whether it will keep ſuſpended a key or other piece of iron which may be at hand. By treating in this manner pieces of different ſteel, it will eaſily be perceived which is capable of lifting the greateſt weight, and conſequently the moſt proper for the conſtruction of the bars.

Having determined the quality of the material, the next thing to be conſidered is the ſhape of the bars; for unleſs the length and breadth of them bear a certain proportion to each other, they will not be capable of receiving their utmoſt power. The beſt ſhape, according to Mr Cavallo, is when the length is ten times the breadth and 20 times the thickneſs. The uſual dimenſions are five inches in length, half an inch in breadth, and a quarter of an inch in thickneſs. Cylindrical bars are leſs convenient.—It is not abſolutely neceſſary to poliſh theſe bars; though it will be better to do ſo, they being in this ſtate much leſs liable to ruſt. One extremity is generally marked with a line all round, to diſtinguiſh one pole from another; and it is the north pole which is uſually marked in this manner. When kept together, the magnetic bars muſt be placed alternately with the marked end of one contiguous to the unmarked end of the other. Two pieces of ſoft iron called *ſupports* always belong to each ſet of bars. Each of theſe is equal in ſize to the half of one of the bars; ſo that when placed contiguous to one another in one direction, they may equal one of the bars. Theſe are uſeful when other bodies are to be rendered magnetic. For the conſtruction of the *Compaſs* and *Dipping-Needle*, ſee theſe articles.

Experiments with the above deſcribed Apparatus.

1. *To determine whether any ſubſtance is attracted by the magnet or not.*—If the ſubſtance to be examined contains iron, the attraction will evidently ſhow itſelf on bringing near it one of the magnetic bars. The quantity of attraction will always be known by the force requiſite to ſeparate them, and its proportion is eſtimated by the degree of that force. Thus if two ounces are required to ſeparate a magnet from any ſubſtance, the degree of attraction is reckoned double to that which requires only one ounce to ſeparate them. If the attraction be ſo ſmall that it cannot be perceived in this way, it muſt be put to ſwim upon water in an earthen or wooden veſſel, by means of a piece of wood or cork. In this way the attraction will be much more eaſily manifeſted by the body coming towards the magnet when approached to it. It will ſometimes be neceſſary to bring the magnet within one-tenth part of an inch of the body to be attracted; and as the latter advances, care muſt be taken to withdraw the magnet; for if they be ſuffered to ſtrike againſt each other, the body, if hard, will generally recede; and it will likewiſe be proper to preſent the magnet to the body when the latter is at reſt.

By letting the ſubſtances to be attracted ſwim upon quickſilver, a ſtill ſmaller degree of attraction can be perceived. In uſing this fluid, the following particulars muſt be attended to. 1. The aperture of the veſſel in which the quickſilver is kept muſt be at leaſt ſix inches in diameter. The reaſon of this is, that, as the ſurface of the quickſilver deſcends near the ſides of the veſſel, the curvature of ſurface formed by that deſcent is proportionably greater in the narrow veſſels than larger ones. If the veſſel is only three or four inches in diameter, the body to be attracted will perpetually run from one ſide to another: a common ſoup-plate, however, will be found a very convenient veſſel for this purpoſe. 2. It will be neceſſary to have the quickſilver very pure; and as it is very difficult to preſerve it in that ſtate, it muſt be frequently paſſed through a piece of writing paper rolled up conically, and having a ſmall aperture of about $\frac{1}{40}$th of an inch diameter in the lower part. 3. The neighbouring air muſt not be diſturbed, that the body may be kept without motion; and while in this ſtate, one of the poles of the magnet is to be preſented to it in the ſame manner as when the experiment is tried with water. It was in this manner that Mr Cavallo made his experiments on the magnetiſm of braſs and other metals of which we have already given an account.

If it be ſuſpected that the given body have ſome magnetiſm already, the very ſame proceſs is required; only obſerving to preſent a piece of ſoft and clean iron to the body when ſwimming upon water or quickſilver. A piece of iron about half an ounce weight, and an inch in length, will be very proper for this purpoſe.

2. *To find the poles of a magnetic body.*—Preſent the various parts of the body ſucceſſively to one of the poles of a magnetic needle, and it will ſoon be diſcovered which parts of the given body are poſſeſſed of a contrary polarity by the needle's ſtanding perpendicularly towards them. One of the poles being thus diſcovered, turn the oppoſite pole of the magnetic needle towards the body, and it will ſoon find out its other pole. When the magnetiſm of the body to be examined is very weak, there will be danger of reverſing the polarity by bringing the needle too near; and as the diſtance at which this effect will take place cannot be determined, it will always be proper to keep it ſo far diſtant that it can only ſenſibly affect the needle. Where there are only two poles, they may be found out merely by ſprinkling ſome iron-filings upon the body; for theſe will ſtand erect upon the polar points. They may be diſtinguiſhed by ſetting the body to float in water, or tying it to a thread and letting it hang

freely, ſo that one may turn towards the north and the other towards the ſouth. This method, however, will not ſucceed when there are more than two poles, nor even very well in that caſe, unleſs they lie in parts directly oppoſite to one another.

3. *Effects of the magnet on ſoft iron.*—Having placed a magnetic needle upon a table, bring a bar of ſoft iron about eight inches long and a quarter of an inch thick, ſo near that it may draw one end of the needle a little out the way. In this ſituation approach gradually the north pole of a magnet to the other extremity of the bar, and the north end of the needle will recede from the bar more and more in proportion as the magnet is brought nearer the bar. If the experiment be repeated with the other pole of the magnet, the north end of the needle will then be attracted by the bar. The reaſon of this is, that when we bring the north pole of the magnet towards one end of the bar, the latter acquires a ſouth polarity, and the other one of courſe a north polarity. Hence the needle is repelled, becauſe magnetic poles of the ſame kind repel one another; but when the ſouth pole is brought near the end of the bar, that end which it approached receives the north polarity, and the other of courſe the ſouth; whence the needle, inſtead of being repelled, is now attracted. By approaching a ſmall magnetic needle to different parts of the bar, it will be found that one half of it poſſeſſes one kind of polarity, and the other the contrary kind; the magnetic centre, however, or the limit betwixt the two polarities, is not always in the middle of the bar, but is generally nearer that end which is preſented to the magnet. The difference increaſes as the bar is lengthened; and when the latter exceeds a certain length it acquires ſeveral poles. This depends on the ſtrength of the magnet; and when it happens, the firſt magnetic centre comes very near to the end of the bar which ſtands next the magnet, and ſucceſſive centres are formed betwixt every two poles. Thus, ſuppoſing the north pole of a magnet to be brought to the end of ſuch a bar, the end it touches becomes a ſouth pole; a few inches farther a north polarity takes place, after that a ſouth polarity, and ſo on. The poles become weaker and weaker as they recede from the end which the magnet touches; ſo that if the bar be of conſiderable length, they totally vaniſh long before they come to the other end. Hence, by applying a magnet to one end of a long bar, we will not thereby give any magnetiſm to the other; and this will happen when a magnet capable of lifting two pounds of iron is applied to a bar of about an inch ſquare and five feet long.

4. *The action of magnetiſm ſhown by the repulſion of two pieces of wire.*—Tie two pieces of ſoft wire each to a ſeparate thread, and having ſuſpended them cloſe by each other, bring one of the poles of a magnet under them, and they will immediately repel; the divergency becoming greater as the magnet is brought nearer within a certain limit, and will decreaſe as the magnet is removed. If ſteel wires or common ſewing needles be uſed, the repulſion will continue for a conſiderable time after the magnet is removed; and this divergency will even be greater after the removal of the magnet, as its attraction tends to draw them nearer each other; and, if brought too near, no repulſion will be ſhown by them. The experiment may be agreeably diverſified by uſing four or more needles, and preſenting a north pole to one pair and a ſouth pole to another, &c.

Plate CCLXXVI.

5. *In what circumſtances a magnet can lift the greateſt weight.*—By means of a crooked wire we may ſhow that the power of a magnet varies according to circumſtances. Thus, let a piece of wire about a quarter of an inch in diameter, and four or five inches long, be bent in the manner repreſented by ABC, fig. 14. with a ſharp corner at C. Tie it faſt to a croſs bar, or let it be held by an aſſiſtant with the corner downwards. Then apply either pole of the magnet DE to one of its extremities; and if in this ſituation a ſmall piece of iron, as H, be put to the corner C, it will remain ſuſpended. On applying the contrary pole of another magnet to the other extremity of the wire, the piece of iron will immediately fall off; but if a pole of the ſame kind be applied it will not only be ſtill kept ſuſpended but be more ſtrongly attracted than before.

In the caſe juſt mentioned, the firſt magnet is aſſiſted by the action of the ſecond; but in order to ſtrengthen a magnet in this manner it does not appear neceſſary to uſe a magnet at all. Thus, having found by trial how much a magnetic bar can lift, procure an oblong piece of iron about four inches long, and ſomewhat heavier than the bar can bear. Apply one end of this to the pole of the bar, holding it with your hand till you place under the other end a larger piece of iron. It will then be found that the magnet will ſupport the piece of iron which it could not do before. The lower piece of iron is to be placed between an inch and three quarters of an inch below the under part of the oblong piece which hangs at the magnet. The ſame effect will be produced by the oppoſite pole of another magnet; but a pole of the ſame denomination would weaken the attraction.

6. *The generation of poles, and of magnetic centres in the part of a broken magnet.*—Take a magnetic bar about ſix or eight inches long and a quarter of an inch diameter, whoſe magnetic centre, will be in the middle, or near it. Break off about one third part by a ſmart ſtroke of an hammer, and it will be found that the broken part, though in the magnet it had but one polarity, will now have acquired a north and ſouth pole, with a magnetic centre, as if it were a diſtinct magnet. The experiment may be diverſified as follows: Having made a ſteel bar about ſix inches long and a quarter of an inch thick quite hard, break it into two unequal parts. Join theſe, and preſs them hard together, giving it the magnetic virtue at the ſame time by means of two powerful magnets: while the parts remain in this poſition, ſo that the bar looks as if it had not been broke, it will have only two poles; but as ſoon as they are ſeparated, each part will be found to become a diſtinct magnet, having a north and ſouth pole proper to itſelf.

7. *To remove the magnetic centre in a magnet.*—This may be done in various ways; as by ſtriking a magnetic bar repeatedly, heating it, hard rubbing, &c.; but in all theſe methods the magnetiſm of the bar is diminiſhed at the ſame time that the centre is removed; ſo that they ought not to be continued beyond what is neceſſary to produce a ſenſible removal of the magnetic centre.

8. *The diſadvantages of uſing magnets of unequal power, and of ſteel not properly hardened.*—Having communicated the magnetic virtue to a ſteel-bar by means of a magnet of any given power, then rub it with a weaker magnet, and it will be found, that the power of the bar, inſtead of being augmented, will now be diminiſhed; being no ſtronger than if it had been rubbed only with the weak magnet. The impropriety of uſing ſoft ſteel in making artificial magnets may be underſtood from the following example: Take two wires about 14 inches long, and one eighth of an inch in thickneſs; let one be of very hard ſteel, the other of ſoft ſteel or iron, though not of the ſofteſt ſort: then, by means of magnetic bars, give the virtue to thoſe wires, treating them both in the ſame manner, and it will be generally found that the hard wire will have only two poles, but the ther a greater number.

9. *To weaken or deſtroy the magnetiſm of a wire by bending.*— Having communicated the magnetic virtue to an iron or ſoft ſteel wire of about four or five inches long and one-twentieth of an inch in diameter, roll it round a ſtick ſo as to make four or five revolutions. When taken off the ſtick it will be found to have its virtue quite deſtroyed, or at leaſt very much weakened by the bending. This effect cannot be produced but when the texture of the wire is ſtrained by the bending; for if it be of ſuch an elaſtic nature as to recover its ſtraightneſs after being once rolled round the ſtick, little change is made on the magnetic power. When only the middle of the wire is bent, little or no change takes place in the magnetic power. If a piece of magnetic wire be cleft, or ſplit lengthwiſe, the parts will ſometimes have the ſame poles, and ſome times the contrary; but when one part is much thinner than the other, the ſlender part will generally have its poles reverſed.

10. *To improve natural magnets.*—This may be done by the ſame methods which are uſed to communicate the virtue to ſteel-bars or to iron-ores: but the natural magnets being generally very ſhort, we can ſeldom do more than place them between two ſtrong magnetic bars: However, when they are of ſufficient length they muſt be rubbed with other bars beſides thoſe between which they are put; uſing the ſame precautions as in making artificial magnets. When ſubjected to this operation, it will always be proper to remove the armature from them.

11. *To arm natural or artificial magnets.*—The firſt ſtep towards this operation is to find out the poles of the magnet, after which it is to be properly ſhaped: that of a parallelopipedon is the beſt; in which caſe care muſt be taken to let the poles fall about the middle of two oppoſite ſurfaces: and in this direction the magnet ought to have the greateſt length poſſible for a natural magnet is weakened much more by having a part cut off from its length than its breadth. This being done, provide two plates of ſoft iron, equal in breadth to thoſe ſurfaces where the poles ſtand, and projecting a little on one ſide of the ſtone, as ſhown by fig. 15. The projections marked DD muſt be much narrower than the breadth of the plates; from a quarter to half an inch being ſufficient for the larger magnets, and about one tenth of an inch for ſmall ones, for the purpoſe of applying to them the ſurface of the iron F. The thickneſs of the plates CD CD muſt be proportioned to the ſtrength of the magnet A B; and this proportion cannot eaſily be determined without an actual experiment. The beſt method, therefore, is to make them ſomewhat thick at firſt, and then keep filing them down as long as the power of the magnet increaſes; after which the filing is to be diſcontinued. The armature may be kept on either by tying or by a box; which laſt is the preferable method. The armature of ſpherical magnets muſt be adapted to their ſhape and each large enough to cover a quarter of it. In like manner may artificial magnets be armed, and thus a compound magnet may be produced much more powerful than any ſingle one. Thus Dr Knight conſtructed two very powerful artificial magnets, or magazines of magnetic bars, which are now in the repoſitory of the Royal Society. Each of theſe conſiſts of 240 bars diſpoſed in four lengths, ſo as to form a parallelopipedon, each length containing 60 bars. They are all kept together by iron braces, and the whole ſuſpended on pivots, with a wooden pedeſtal or carriage, by which they may be eaſily placed in any required poſition. If the artificial magnets be made in the ſhape of a horſe-ſhoe or a ſemicircle, they have no occaſion for armature, it being ſufficient to join them either by rivetting or by means of a box; and indeed even when ſtraight bars are uſed, a compound magnet may be made without armature; but then as the poles cannot act in the ſame plain, it is neceſſary to have two magazines in order to give magnetiſm the more conveniently to other bodies. The power of a magnet is rather augmented by being armed, for the ſame reaſon that it is increaſed by a piece of iron affixed to it. E is a braſs ring, by which it may be ſuſpended with the iron adhering to it, which is the beſt method for preſerving its virtue.

12. *Magnetiſm requires ſome time to penetrate thro' iron.* Having placed a bulky piece of iron, ſuppoſe one weighing 40 or 50 pounds, ſo near a magnetic needle as to draw it a little out of its direction, apply one of the poles of a ſtrong magnet to the other extremity of the iron, and you will find that it requires ſome ſeconds before the needle can be affected by it. The interval is greater or leſs according to the ſize of the iron and the ſtrength of the magnet.

CHAP. IV. *Entertaining Experiments.*

Plate CCLXXVI.

Conſtruction of the MAGNETIC PERSPECTIVE-GLASS.] Provide an ivory tube, about two inches and a half long, and of the form expreſſed in fig. 16. The ſides of this tube muſt be thin enough to admit a conſiderable quantity of light. It is to open at one end with a ſcrew; at that end there muſt be placed an eye-glaſs of about two inches focus, and at the other end any glaſs you pleaſe. Have a ſmall magnetic needle, like that placed on a compaſs. It muſt be ſtrongly touched, and ſo placed at the bottom of the tube that it may turn freely round. It is to be fixed on the centre of a ſmall ivory circle C, of the thickneſs of a counter, which is placed on the object,glaſs D, and painted black on the ſide next it. This circle muſt be kept faſt by a circular rim of paſteboard, that the needle may not riſe off its pivot, after the ſame manner as in the compaſs. This tube will thus become a compaſs, ſufficiently tranſparent to

Entertaining Experiments.

ſhow the motions of the needle. The eye-glaſs ſerves more clearly to diſtinguiſh the direction of the needle; and the glaſs at the other end, merely to give the tube the appearance of a common perſpective. It will appear from the laws of magnetiſm already laid down, that the needle in this tube, when placed over, and at a ſmall diſtance from, a magnet, or any machine in which it is contained, will neceſſarily place itſelf in a poſition directed by that magnet, and conſequently ſhow where the north and ſouth pole of it is placed; the north end of the needle conſtantly pointing to the ſouth end of the magnet. This effect will take place, though the magnet be incloſed in a caſe of wood, or even metal, as the magnetic effluvia penetrates all bodies. You muſt obſerve, however, that the attracting magnet muſt not be very far diſtant from the needle, eſpecially if it be ſmall, as in that caſe its influence extends but to a ſhort diſtance. This tube may be differently conſtructed, by placing the needle in a perpendicular direction, on a ſmall axis of iron, on which it muſt turn quite freely, between two ſmall plates of braſs placed on each ſide the tube; the two ends of the needle ſhould be in exact equilibrium. The north and ſouth ends of this needle will, in like manner, be attracted by the ſouth and north ends of the magnetic bar. The former conſtruction, however, appears preferable, as it is more eaſily excited, and the ſituation of the needle much more eaſily diſtinguiſhed.

Exp. I. *The magnetic paradox.*

Plate CCLXXVII.

Having placed a ſmall piece of iron wire not above a tenth part of an inch long upon a table AB, fig. 17. Hold the magnetic bar EF about four or five inches above the table, with either of its poles pointing to the table, and ſo that the perpendicular let fall from the pole may touch the table at G, two or three inches from the wire, which diſtances, however, are ſubject to variations ariſing from the power of the magnet.—When the magnet is held in a proper poſition with reſpect to the iron, the latter will elevate one of its ends, as is ſhown at CD, forming an angle with the table, which is larger the nearer the wire comes to the point G, where it ſtands quite upright. Knock the table gently, and the wire CD will gradually proceed towards G, every knock making it jump up and advance a little way. This will naturally be attributed to the attraction of the magnet; which not being ſufficiently ſtrong to draw the wire directly towards it is juſt able to bring it gradually towards G when the motion of the table lifts it up. But if, inſtead of holding the magnet over the table, it be placed before it at HI, the wire will now make an obtuſe angle towards G; as is ſhown at KL, and, on knocking the table, will recede from the magnet as if repelled, though in truth it is as much attracted as before.

The cauſe of this ſeeming repulſion will be underſtood from fig. 18. where the wire is repreſented by KL, and the magnet by H. The former being rendered magnetic by the proximity of the magnet H, is inclined to it according to the laws already laid down; but, by reaſon of its weight, and being ſupported only at one end, it inclines leſs than it would do if it were freely ſuſpended by its centre. Let MN be a line paſſing through the centre of the wire; then by the motion of the table, the wire being lifted up, the end K will be at liberty to deſcend farther in the direction in which it is attracted by the magnet than it was before. It will then take the poſition repreſented by *r* Q, its centre remaining nearly in the ſame perpendicular MN. We ſay nearly, becauſe the action of the magnet will undoubtly move the whole wire ſomewhat nearer to itſelf; and the motion of the centre will be a diagonal compounded of the forces of gravity and of the magnet. The latter, however, being much ſmaller, will, by conſpiring with the action of gravity, draw down the neareſt end of the wire *r* ſo far, that a perpendicular line PO let fall from the extremity of it will touch the table in a point farther diſtant from the magnet than K. In this perpendicular the wire will depend very nearly, and then reſume its proper ſituation, parallel, or nearly ſo, to KL; when a ſecond knock will remove it a little farther off, for the reaſon already aſſigned. The former part of the experiment may be eaſily explained upon the ſame principles. The whole may be diverſified by uſing iron-filings inſtead of the wire. In this caſe, when the magnet is held over the table, they will be gradually collected about the point G, and diſperſed from it while the magnet is held under.

2. *The communicative crown.*

Take a crown piece, and bore a hole in the ſide of it; in which place a piece of wire, or a large needle, well poliſhed, and ſtrongly touched with a magnet. Then cloſe the hole with a ſmall piece of pewter, that it may not be perceived. Now the needle in the magnetic perſpective before deſcribed, when it is brought near to this piece of money, will fix itſelf in a direction correſpondent to the wire or needle in that piece. Deſire any perſon to lend you a crown piece, which you dexterouſly change for one that you have prepared as above. Then give the latter piece to another perſon, and leave him at liberty either to put it privately in a ſnuff-box, or not; he is then to place the box on a table, and you are to tell him, by means of your glaſs, if the crown is or is not in the box. Then bringing your perſpective cloſe to the box, you will know by the motion of the needle, whether it be there or not; for as the needle in the perſpective will always keep to the north of itſelf, if you do not perceive it has any motion, you conclude the crown is not in the box. It may happen, however, that the wire in the crown may be placed to the north, in which caſe you will be deceived. Therefore to be ſure of ſucceſs, when you find the needle in the perſpective remain ſtationary, you may make ſome pretence to deſire the perſon to move the box into another poſition, by which you will certainly know if the crown-piece be there or not.—You muſt remember, that the needle in the perſpective muſt here be very ſenſible, as the wire in the crown cannot poſſibly have any great attractive force.

2. *The magnetic table.*

Under the top of a common table place a magnet that turns on a pivot, and fix a board under it, that nothing may appear. There may alſo be a drawer under the table, which you pull out to ſhow that there is nothing concealed. At one end of the table there muſt

MAGNETISM.

Plate CCLXXVII.

Fig. 17.

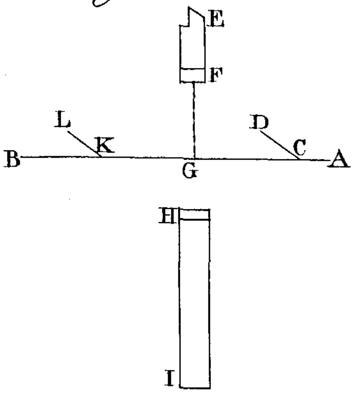


Fig. 18.

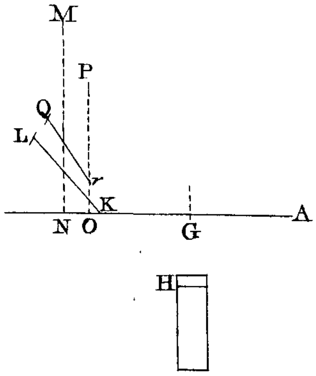


Fig. 19.

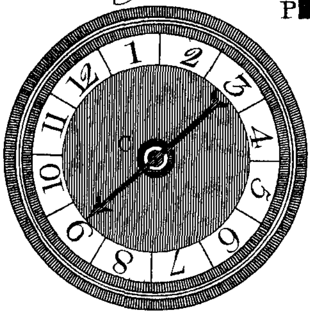


Fig. 20.

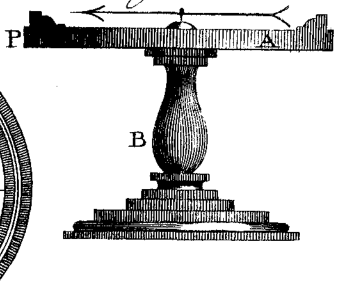


Fig. 21.

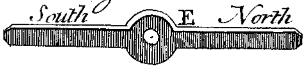


Fig. 22.

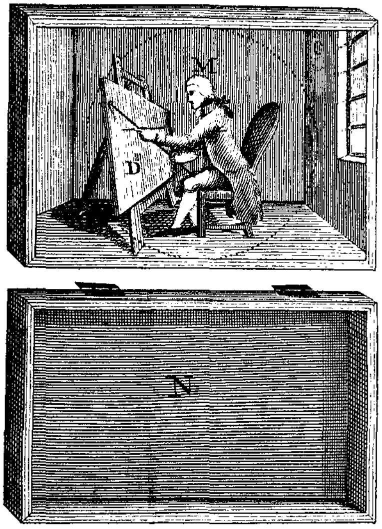


Fig. 23.

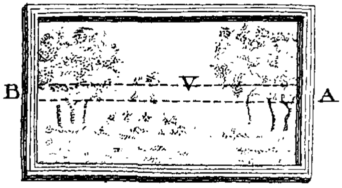


Fig. 25.

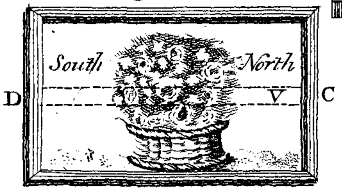


Fig. 27.

Fig. 28.

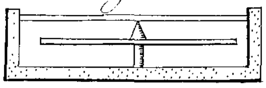


Fig. 24.

Fig. 26.

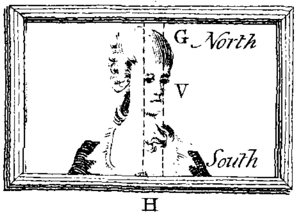


Fig. 29.

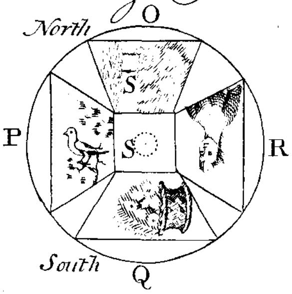


Fig. 30.

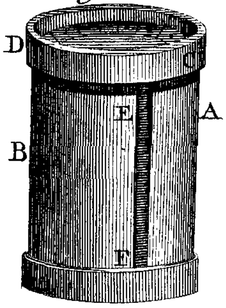


Fig. 31.

Fig. 32.

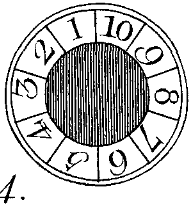


Fig. 33.

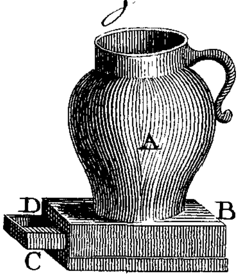


Fig. 34.

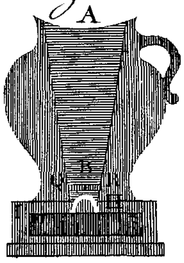


Fig. 36.

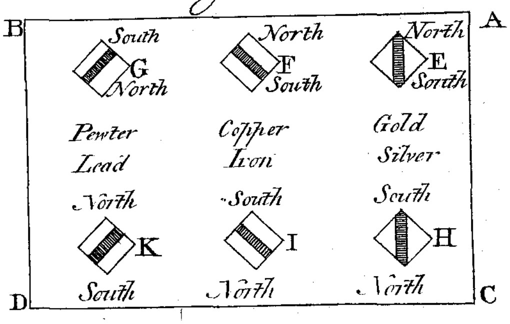
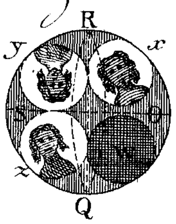
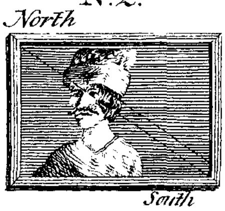


Fig. 35.

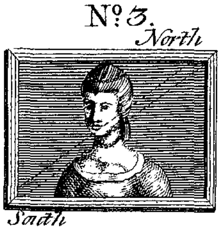


Nº 1.

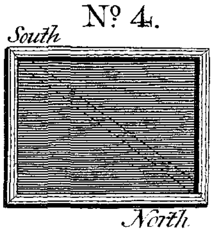
Nº 2.



Nº 3.



Nº 4.



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muſt be a pin that communicates with the magnet, and by which it may be placed in different poſitions; this pin muſt be ſo placed as not to be viſible to the ſpectators. Strew ſome ſteel-filings or very ſmall nails over that part of the table where the magnet is. Then aſk any one to lend you a knife, or a key, which will then attract part of the nails or filings. Then placing your hand in a careleſs manner on the pin at the end of the table, you alter the poſition of the magnet; and giving the key to any perſon, you deſire him to make the experiment, which he will then not be able to perform. You then give the key to another perſon; at the ſame time placing the magnet, by means of the pin, in the firſt poſition, when that perſon will immediately perform the experiment.

4. *The myſterious watch.*

You deſire any perſon to lend you his watch, and aſk him if he thinks it will or will not go when it is laid on the table. If he ſay it will, you place it over the end of the magnet, and it will preſently ſtop (A). You then mark with chalk, or a pencil, the preciſe point where you placed the watch; and moving the poſition of the magnet, as in the laſt experiment you give the watch to another perſon, and deſire him to make the experiment; in which he not ſucceeding, you give it to a third perſon, at the ſame time replacing the magnet, and he will immediately perform the experiment.

5. *The magnetic dial.*

Provide a circle of wood or ivory, of about five or ſix inches diameter, as fig. 19. which muſt turn quite free on the ſtand B (fig. 20.) in the circular border A: on the circle muſt be placed the dial of paſteboard C (fig. 19.) whoſe circumference is to be divided into 12 equal parts, in which muſt be inſcribed the numbers from 1 to 12, as on a common dial. There muſt be a ſmall groove in the circular frame D, to receive the paſteboard circle: and obſerve, that the dial muſt be made to turn ſo free, that it may go round without moving the circular border in which it is placed. Between the paſte-board circle and the bottom of the frame, place a ſmall artificial magnet E (fig. 21.), that has a hole in its middle, or a ſmall protuberance. On the outſide of the frame place a ſmall pin P, which ſerves to ſhow where the magnetic needle I, that is placed on a pivot at the centre of the dial is to ſtop. This needle muſt turn quite free on its pivot, and its two ſides ſhould be in exact equilibrium. Then provide a ſmall bag, that has five or ſix diviſions, like a lady's work-bag, but ſmaller. In one of theſe diviſions put ſmall ſquare pieces of paſteboard, on which are wrote the numbers from 1 to 12, and if you pleaſe you may put ſeveral of each number. In each of the other diviſions you muſt put 12 or more like pieces; obſerving, that all the pieces in each diviſion muſt be marked with the ſame number. Now the needle being placed upon its pivot, and turned quickly about, it will neceſſarily ſtop at that point where the north end of magnetic bar is placed, and which you previouſly know by the ſituation of the ſmall pin in the circular border. You therefore preſent to any perſon that diviſion of the bag which contains the ſeveral pieces on which is wrote the number oppoſite to the north end of the bar, and tell him to draw any one of them he pleaſes. Then placing the needle on the pivot, you turn it quickly about, and it will neceſſarily ſtop, as we have already ſaid, at that particular number.

Another experiment may be made with the ſame dial, by deſiring two perſons to draw each of them one number out of two different diviſions of the bag; and if their numbers, when added together, exceed 12, the needle or index will ſtop at the number they exceed it; but if they do not amount to 12, the index will ſtop at the ſum of thoſe two numbers. In order to perform this experiment, you muſt place the pin againſt the number 5, if the two numbers to be drawn from the bag be 10 and 7; or againſt 9 if they be 7 and 2.—If this experiment be made immediately after the former, as it eaſily may, by dexterouſly moving the pin, it will appear the more extraordinary.

6. *The dexterous painter.*

Provide two ſmall boxes, as M and N (fig. 22), four inches wide, and four inches and a half long. Let the box M be half an inch deep, and N two thirds of an inch. They muſt both open with hinges, and ſhut with a claſp. Have four ſmall pieces of light wood, (fig. 23, 24, 25, 26.) of the ſame ſize with the inſide of the box M (fig. 22.), and about one third of an inch thick. In each of theſe let there be a groove, as AB, EF, CD, GH; theſe grooves muſt be in the middle, and parallel to two of the ſides. In each of theſe grooves place a ſtrong artificial magnet, as fig. 27. The poles of theſe magnets muſt be properly diſpoſed with regard to the figures that are to be painted on the boards; as is expreſſed in the plate. Cover the bars with paper, to prevent their being ſeen; but take care, in paſting it on, not to wet the bars, as they will thereby ruſt, which will conſiderably impair their virtue. When you have painted ſuch ſubjects as you chooſe, you may cover them with a very thin clear glaſs. At the centre of the box N, place a pivot (fig. 28.), on which a ſmall circle of paſteboard OPQR (fig. 29.) is to turn quite free; under which is to be a touched needle S. Divide this circle into four parts, which are to be diſpoſed with regard to the poles of the needle, as is expreſſed in the figure. In theſe four diviſions you are to paint the like ſubjects as are on the four boards, but reduced to a ſmaller compaſs. Cover the inſide of the top of this box with a paper M, (ſee fig. 22.) in which muſt be an opening D, at about half an inch from the centre of the box, that you may perceive, ſucceſſively, the four ſmall pictures on the paſteboard circle juſt mentioned. This opening is to ſerve as the cloth on which the little painter is ſuppoſed to draw one of the pictures. You may cover the top of the box, if you pleaſe, with a thin glaſs. Then give the firſt box to any perſon, and tell him to place any one of the four pictures in it privately, and when he has cloſed it, to give it you. You then place the other box over it; when the moveable circle, with the needle, will turn till it comes in the ſame poſition with the bar in the firſt

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(A) To perform this experiment, you muſt uſe a ſtrong magnetic bar; and the balance of the watch muſt not be of braſs, but ſteel.

firſt box. It wil then appear that the little dexterous painter has already copied the picture that is incloſed in the firſt box.

7. *The cylindric oracle.*

Provide a hollow cylinder of about ſix inches high and three wide, as AB, fig. 30. Its cover CD muſt be made to fix on any way. On one ſide of this box or cylinder let there be a groove, nearly of the ſame length with that ſide; in which place a ſmall ſteel bar (fig. 31). that is ſtrongly impregnated, with the north pole next the bottom of the cylinder. On the upper ſide of the cover deſcribe a circle; and divide it into ten equal parts, in which are to be wrote the numbers from 1 to 10, as is expreſſed in fig. 32. Place a pivot at the centre of this circle, and have ready a magnetic needle. You are then to provide a bag, in which there are ſeveral diviſions, like that deſcribed in exper. 5. In each of theſe diviſions put a number of papers, on which the ſame or ſimilar queſtions are wrote. In the cylinder put ſeveral different anſwers to each queſtion, and ſeal them up in the manner of ſmall letters. On each of theſe letters or anſwers is to be wrote one of the numbers of the dial or circle at the top of the box. You are ſuppoſed to know the number of the anſwers to each queſtion. You then offer one of the diviſions of the bag, obſerving which diviſion it is, to any perſon, and deſire him to draw one of the papers. Next put the top on the cylinder, with that number which is wrote on the anſwer directly over the bar. Then placing the needle on the pivot, you turn it briſkly about, and it will naturally ſtop at the number over the bar. You then deſire the perſon who drew the queſtion to obſerve the number at which the needle ſtands, and to ſearch in the box for a paper with the ſame number, which he will find to contain the anſwer.—You may repeat the experiment by offering another diviſion of the bag to the ſame or another perſon; and placing the number that correſponds to the anſwer over the magnetic bar, proceed as before.

It is eaſy to conceive of ſeveral anſwers to the ſame queſtion. For example, ſuppoſe the queſtion to be, Is it proper to marry?

Anſwer 1. While you are young, not yet; when you are old, not at all.

2. Marry in haſte, and repent at leiſure.

3. Yes, if you can get a good fortune; for ſomething has ſome ſavour, but nothing has no flavour.

4. No, if you are apt to be out of humour with yourſelf; for then you will have two perſons to quarrel with.

5. Yes, if you are ſure to get a good huſband (wife); for that is the greateſt bleſſing of life. But take care you are ſure.

6. No, if the perſon you would marry is an angel; unleſs you will be content to live with the devil.

8. *The inchanted ewer.*

Fix a common ewer, as A, (fig. 33.) of about 12 inches high, upon a ſquare ſtand BC; in one ſide of which there muſt be a drawer D, of about four inches ſquare and half an inch deep. In the ewer place a hollow tin cone, inverted, as AB, fig. 34. of about four inches and a half diameter at top, and two inches at the bottom; and at the bottom of the ewer there muſt likewiſe be a hole of two inches diameter.

Upon the ſtand, at about an inch diſtance from the bottom of the ewer, and directly under the hole, place a ſmall convex mirror H, of ſuch convexity that a perſon's viſage, when viewed in it, at about 15 inches diſtance, may not appear above two inches and a half long.

Upon the ſtand likewiſe, at the point I, place a pivot of half an inch high, on which muſt be fixed a touched needle RQ, incloſed in a circle of very thin paſteboard OS, fig. 35. of five inches diameter. Divide this paſteboard into four parts, in each of which draw a ſmall circle: and in three of theſe circles paint a head as *x*, *y*, *z*, the dreſs of each of which is to be different, one, for example, having a turban, another a hat, and the other a woman's cap. Let that part which contains the face in each picture be cut out, and let the fourth circle be entirely cut out; as it is expreſſed in the figure. You muſt obſerve, that the poles of the needle are to be diſpoſed in the ſame manner as in the plate.

You are next to provide four ſmall frames of wood or paſteboard, n° 1, 2, 3, 4, each of the ſame ſize with the inſide of the drawer. On theſe frames muſt be painted the ſame figures as on the circular paſteboard; with this difference, that there muſt be no part of them cut out. Behind each of theſe pictures place a magnetic bar, in the ſame direction as is expreſſed in the plate; and cover them over with paper, that they may not be viſible. Matters being thus prepared, you firſt place in the drawer the frame n° 4. on which there is nothing painted. You then pour a ſmall quantity of water into the ewer, and deſire the company to look into it, aſking them if they ſee their own figures as they are. Then you take out the frame n° 4. and give the three others to any one, deſiring him to chooſe in which of thoſe dreſſes he would appear. Then put the frame with the dreſs he has choſe in the drawer; and a moment after, the perſon looking into the ewer will ſee his own face ſurrounded with the dreſs of that picture. For, the paſteboard circle (divided, as above deſcribed, into four parts, in three of which are painted the ſame figures as on three of the boards, and the fourth left blank) containing a magnetic needle, and the four boards having each a concealed magnet; therefore, when one of them is put in the drawer under the ewer the circle will correſpond to the poſition of that magnet, and conſequently the perſon looking into the top of the ewer will ſee his own face ſurrounded with the head-dreſs of the figure in the drawer.—This experiment, well performed, is highly agreeable. As the paſteboard circle can contain only three heads, you may have ſeveral ſuch circles, but you muſt then have ſeveral other frames: and the ewer muſt then be made to take off from the ſtand.

9. *The box of metals.*

Provide a wooden box, about 13 inches long and ſeven wide, as ABCD (fig. 36.). The cover of this box ſhould be as thin as poſſible. Have ſix ſmall boxes or tables, about an inch deep, all of the ſame ſize and form, as EFGHIK, that they may indiſcriminately

nately go into ſimilar holes made in the bottom of the large box. In each of theſe tablets is to be placed a ſmall magnetic ball and their poles are to be diſpoſed as expreſſed in the figure. Cover each of theſe tablets with a thin plate of one of the ſix following metals, viz. gold, ſilver, copper, iron, pewter, and lead. You muſt alſo have a magnetic perſpective, at the end of which is to be two circles, one divided into ſix equal parts, and the other into four, as in fig. 37. from the centre of which there muſt be drawn an index N, whoſe point is to be placed to the north. Therefore, when you are on the ſide CD of the box, and hold your perſpective over any one of the tablets that are placed on the holes E, F, G, ſo that the index drawn on the circle is perpendicular to the ſide AB, the needle in the perſpective will have its ſouth pole directed to the latter that denotes the metal contained in that tablet. When you hold the perſpective over one of the boxes placed in the holes H, I, K, ſo that the index drawn on the circle is perpendicular to the ſide CD, the ſouth pole of the needle will in like manner expreſs the name of the metal incloſed. If the under ſide of any one of the tablets be turned upwards, the needle will be ſlower in its motion, on account of the greater diſtance of the bar. The gold and ſilver will ſtill have the ſame direction; but the four other metals will be expreſſed by the letters on the interior circle. If any one of the metals be taken away, the needle will not then take any of the above directions, but naturally point to the north; and its motion will be much ſlower. You therefore give the box to any one, and leave him at liberty to diſpoſe of all the tablets in what manner and with what ſide upward he pleaſes, and even to take any one of them away. Then, by the aid of your perſpective, you tell him immediately the name of the metal on each tablet, and of that he has taken away.

Plate CCLXXVIII.

This box of metals will, on compariſon, be found far to exceed that which has been publicly exhibited: for that, being compoſed of ſix tablets, of which two only differ in form, admits but of ſix different diſpoſitions, whereas in this the tablets may be placed 720 different ways. In the other, you muſt alſo know the particular ſide of the box, which in this is not at all neceſſary. Nay, you may here diſtinguiſh each metal, though the box be completely covered with paper; for the effect of the needle will be always the ſame. The experiments with this box are therefore much more extraordinary, and its conſtruction at the ſame time more ſimple.

10. *The magnetic planetarium.*

CONSTRUCT a round box, ILMN, (fig. 38,) of eight or nine inches diameter, and half an inch deep. On its bottom fix a circle of paſteboard, on which draw the central circle A, and the ſeven circumjacent circles B, C, D, E, F, G, H. Divide the central circle into ſeven equal parts by the lines AB, AC, AD, AE, AF, AG, and AH, which muſt paſs through the centres of the other circles, and divide each of them into two equal parts. Then divide the circumference of each of thoſe circles into 14 equal parts, as in the figure. You are likewiſe to have another paſteboard of the ſame figure, and divided in the ſame manner, which muſt turn freely in the box by means of an axis placed on a pivot; one end of which is to be fixed in the centre of the circle A. (See fig. 39.) On each of the ſeven ſmaller circles at the bottom of the box, place a magnetic bar, two inches long, in the ſame direction with the diameters of thoſe circles, and their poles in the ſituation expreſſed in the figure. There muſt be an index O (fig. 39.), like that of the hour-hand of a dial, which is to be fixed on the axis of the central circle, and by which the paſteboard circle in the box may be turned about. There muſt be alſo a needle P, which muſt turn freely on the axis, without moving the circular paſteboard.—In each of the ſeven diviſions of the central circle write a different queſtion; and in another circle, divided into 12 parts, you may write the names of the 12 months. In each of the ſeven circles write two anſwers to each queſtion, obſerving that there muſt be but ſeven words in each anſwer; in the following manner. In the firſt diviſion of the circle G fig. 37. which is oppoſite to the firſt queſtion, write the firſt word of the firſt anſwer. In the ſecond diviſion of the next circle, write the ſecond word; and ſo on to the laſt word, which will be in the ſeventh diviſion of the ſeventh circle. In the eighth diviſion of the firſt circle, write the firſt word of the ſecond anſwer; in the ninth diviſion of the ſecond circle, write the ſecond word of the ſame anſwer; and ſo on to the 14th diviſion of the ſeventh circle, which muſt contain the laſt word of that anſwer. The ſame muſt be done for all the ſeven queſtions; and to each of them muſt be aſſigned two anſwers, the words of which are to be diſperſed through the ſeven circles. At the centre of each of theſe circles place a pivot; and have two magnetic needles, the pointed end of one of which muſt be north, and the other ſouth, QR, fig. 39.) Now, the index of the central circle being directed to any one of the queſtions, if you place one of the two magnetic needles on each of the ſeven leſſer circles, they will fix themſelves according to the direction of the bars on the correſpondent circles at the bottom of the box, and conſequently point to the ſeven words that compoſe the anſwer. If you place one of the other needles on each circle, it will point to the words that are diametrically oppoſite to thoſe of the firſt anſwer, the north pole being in the place of the ſouth pole of the other.—You therefore preſent this planetarium to any perſon, and deſire him to chooſe one of the queſtions there wrote; and you then ſet the index of the central circle to that queſtion, and putting one of the needles on each of the ſeven circles, you turn it about; and when they all ſettle, they will point to the ſeven words that compoſe the anſwer. The two anſwers may be one favourable and the other unfavourable; and the different needles will ſerve to diverſify the anſwers when you repeat the experiment.

There may be alſo a moveable needle to place againſt the names of the months; and when the party has fixed upon a queſtion, you place that needle againſt the month in which he was born, which will give the buſineſs an air of more myſtery. On the centre of the large circle may be the figure of the ſun; and on each of the ſeven ſmaller circles one of the characters of the five planets, together with the earth and moon. This

Entertaining Experiments.

experiment, well executed, is one of the moſt entertaining that magnetiſm has produced.

11. *The ſagacious ſwan.*

Plate CCLXXVIII. Fig. 40.

PROVIDE a box XY, 18 inches long, 9 wide, and 2 deep, the top of which is to ſlide on and off at the end Y. Towards the end X deſcribe a circle of ſix inches diameter, round which are to be fixed ſix ſmall vaſes of wood or ivory, of one inch and a half high; and to each of them there muſt be a cover. At the end Y place an egg B, of ivory or other matter, of about three inches and a half high, with a cover that ſhuts by a hinge, and faſtens with a ſpring. It muſt be fixed on the ſtand C; through which, as well as the bottom of the egg, and the part of the box directly underneath, there muſt paſs a hole of one-third of an inch in diameter. In this cavity place an ivory cylinder F, that can move freely, and riſes or falls by means of the ſpring R. You muſt have a thin copper baſon A, of ſix inches diameter, which is to be placed on the centre of the circle at X, and conſequently in the middle of the ſix vaſes. Let a proper workman conſtruct the movement expreſſed by fig. 41. which is compoſed of a quadrant G, that has 16 teeth, and is moveable about an axis in the ſtand H, that has an elbow, by which it is ſcrewed to the bottom of the box at L. To the quadrant there muſt be joined the ſtraight piece K. The horizontal wheel M has 24 teeth; and is ſupported by the piece S, which is ſcrewed to the end of the box next Y. On the axis of this wheel place a braſs rod OP, five inches long; and at the part O place a large bar or horſe-ſhoe, of a ſemicircular form, and about two inches and a half diameter, ſtrongly impregnated. The ſteel rod V, takes at one end the teeth of the quadrant G, by the pinion F, and at the other end the wheel M, by the perpendicular wheel N, of 30 teeth; the two ends of this rod are ſupported by the two ſtands that hold the other pieces. Under the piece K, that joins to the quadrant, muſt be placed the ſpring R, by which it is raiſed, and puſhes up the cylinder that goes through the ſtand C into the egg. You muſt alſo have ſix ſmall etwees or caſes, as Y, Y, Y, Y, Y, Y. They muſt be of the ſame circumference with the cylinder in the ſtand, and round at their extremities; their length muſt be different, that, when they are placed in the egg, and the lower end enters the hole in which is the cylinder, they may thruſt it down more or leſs, when the top of the egg, againſt which they preſs, is faſtened down; and thereby lower the bar that is fixed to the end of the quadrant, and conſequently, by means of the pinion Z and wheels NM turn the horſe-ſhoe that is placed upon the axis of the laſt wheel. The exact length of theſe etwees can be determined by trials only; which trials, however, may be made with round pieces of wood. In each of theſe etwees place a different queſtion, wrote on a ſlip of paper and rolled up, and in each of the vaſes put the anſwer to one of the queſtions; as you will know, by trials, where the magnetic bar or horſe-ſhoe will ſtop. Laſtly, provide a ſmall figure of a ſwan, or what other you pleaſe, made of cork or enamel, in which you muſt fix a touched needle, of the largeſt ſize of thoſe commonly uſed in ſewing.

Entertaining Experiments.

Being thus prepared, you offer a perſon the ſix etwees, and deſire him to chooſe any one of them himſelf, and conceal the others, or give them to different perſons. He is then to open his etwee, read the queſtion it contains to himſelf, and return the etwee to you, after replacing the queſtion. You then put the etwee in the egg, and placing the ſwan upon the water in the baſon, you tell the company ſhe will preſently diſcover in which of the vaſes the anſwer is contained. The ſame experiment may be repeated with all the etwees.

12. *The multifarious verſe.*

THE eight words that compoſe this Latin verſe,

Tot ſunt tibi dotes, quot cœli ſidera, virgo (A),

being privately placed in any one of the different combinations of which they are ſuſceptible, and which are 40320 in number, to tell the order in which they are placed.

Fig. 42.

Provide a box that ſhuts with hinges, and is eight inches long, three wide, and half an inch deep. Have eight pieces of wood about one third of an inch thick, two inches long, and one and a half wide, which will therefore, when placed cloſe together, exactly fill the box. In each of theſe pieces or tablets place a magnetic bar, with their poles as is expreſſed in the figure. The bars being covered over, write on each of the tablets, in the order they then ſtand, one of the words of the foregoing Latin verſe. On a very thin board of the ſame dimenſions with the box, draw the eight circles, A, B, C, D, E, F, G, H, (fig. 43.) whoſe centres ſhould be exactly over thoſe of the eight tablets in the box when the board is placed upon it. Divide each of thoſe circles into eight parts, as in the figure; and in each of thoſe diviſions write one of the words of the Latin verſe, and in the preciſe order expreſſed in the plate; ſo that, when the board is placed over the box, the eight touched needles placed at the centre of the circles may be regulated by the poles of the bars in the box, and conſequently the word that the needle points to in the circle be the ſame with that inſcribed on the tablet. Cover the board with a glaſs, to prevent the needles from riſing off their pivots, as is done in the ſea-compaſs. Over the board place four plates of glaſs, I, L, M, N, fig. 44. which will give the machine the figure of a truncated pyramid, of eight inches high. Cover it with a glaſs, or rather a board, in which are placed two lenſes, O O, of eight inches focus, and diſtant from each other about half an inch. Line the four plates of glaſs that compoſe the ſides with very thin paper, that will admit the light, and at the ſame time prevent the company from ſeeing the circles on the board.

Theſe preparations being made, you give the box to any one; and tell him to place the tablets on which the words are wrote, privately, in what poſition he thinks proper, then to cloſe the box, and, if he pleaſe, to wrap it up in paper, ſeal it, and give it you. Then placing the board with the pyramid upon it, you immediately tell him the order in which the tablets are placed, by reading the words to which the needles on the circles point.

(A) *i. e.* Thy virtues, virgin, are as numerous as the ſtars of heaven.

MAGNETISM.

Plate CCLXXVIII.

Fig: 37.

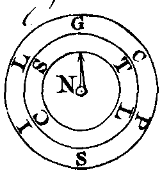


Fig: 39.

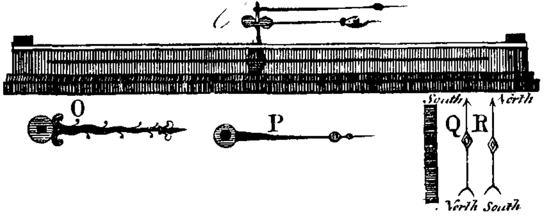


Fig: 38.

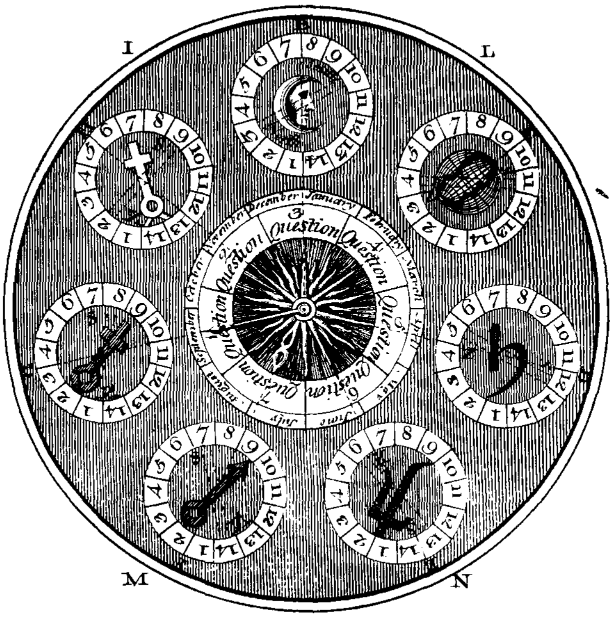


Fig. 41.

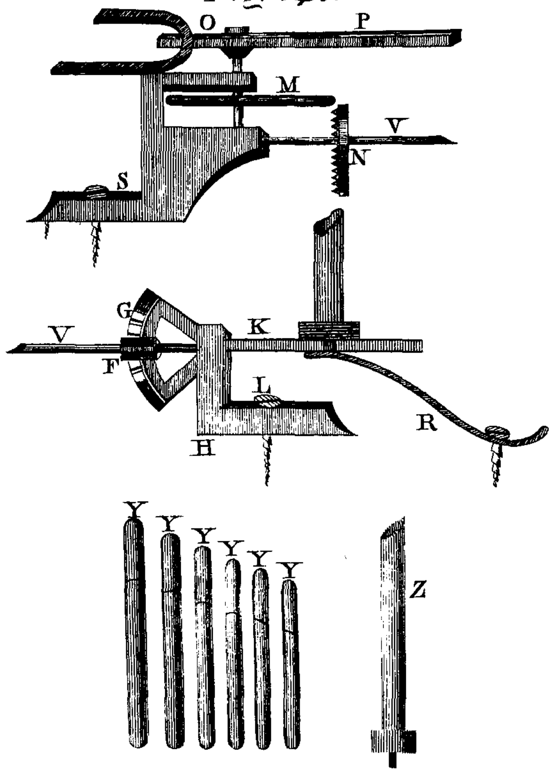


Fig: 40.

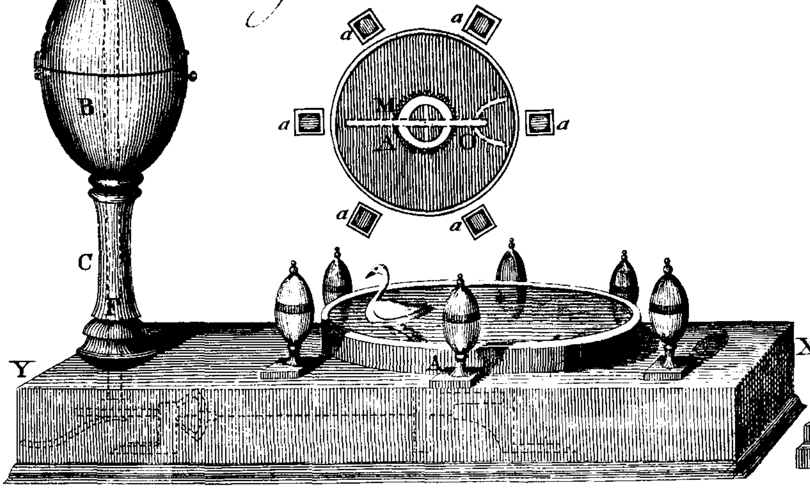


Fig: 44.

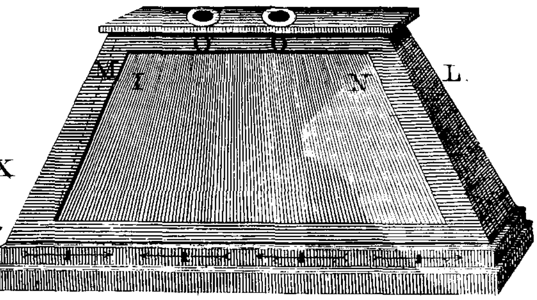


Fig: 42.

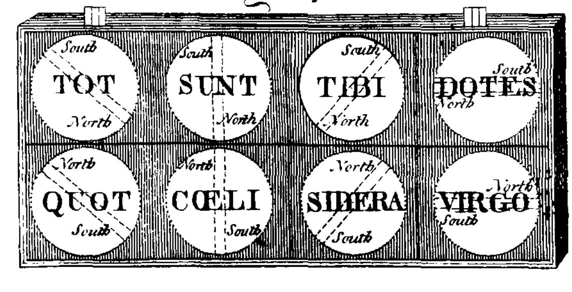
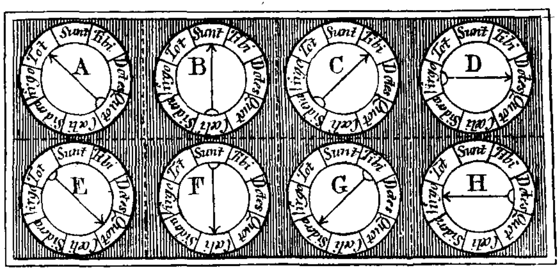


Fig: 43.



Thackara & Vallance sc.

Animal MAGNETISM, a ſympathy lately ſuppoſed by ſome perſons to exiſt between the magnet and the human body; by means of which the former became capable of curing many diſeaſes in an unknown way, ſomething reſembling the performances of the old magicians.

The fanciful ſyſtem, to call it by no worſe name, of animal magnetiſm, appears to have originated, in 1774, from a German philoſopher named *Father Hehl*, who greatly recommended the uſe of the magnet in medicine. M. Meſmer, a phyſician of the ſame country, by adopting the principles of Hehl, became the direct founder of the ſyſtem; but, afterwards deviating from the tenets of his inſtructor, he loſt his patronage, as well as that of Dr Ingenhouſz, which he had formerly enjoyed. Meſmer had already diſtinguiſhed himſelf by "A diſſertation on the influence of the Stars upon the human body," which he publicly defended in a theſis before the univerſity of Vienna; but he was ſo unable to ſtand before the oppoſition of Hehl and Igenhouſz, that his ſyſtem fell almoſt inſtantly into diſrepute. Meſmer appealed to the academy of ſciences at Berlin: but they rejected his principles as deſtitute of foundation, and unworthy of the ſmalleſt attention. He then made a tour through Germany, publiſhing every where the great cures he performed by means of his animal magnetiſm, while his enemies every where purſued him with detections of the falſehood of his aſſertions.

Meſmer, ſtill undaunted by ſo many defeats, returned to Vienna; but meeting there with no better ſucceſs than before, he retired to Paris in the beginning of the year 1778. Here he met with a very different reception. He was firſt patroniſed by the author of the *Dictionaire des Merveilles de la nature*; in which work a great number of his cures were publiſhed, Meſmer himſelf receiving likewiſe an ample teſtimony of his candour and *ſolid reaſoning*. Our phyſician ſoon collected ſome patients; and in the month of April 1778 retired with them to Creteil, from whence he in a ſhort time returned with them perfectly cured. His ſucceſs was now as great as his diſappointment had been before. Patients increaſed ſo rapidly that the Doctor was ſoon obliged to take in pupils to aſſiſt him in his operations. Theſe pupils ſucceeded equally well as Meſmer himſelf; and ſo well did they take care of their own emolument, that one of them, named M. Deſlon, realized upwards of L. 100,000 Sterling. In 1779 Meſmer publiſhed a memoir on the ſubject of Animal Magnetiſm, promiſing afterwards a complete work upon the ſame, which ſhould make as great a revolution in philoſophy as it had already done in medicine.

The new ſyſtem now gained ground daily; and ſoon became ſo faſhionable, that the jealouſy of the faculty was thoroughly awakened, and an application concerning it was made to government. In conſequence of this a committee was appointed to inquire into the matter, conſiſting partly of phyſicians and partly of members of the royal academy of ſciences with Dr Benjamin Franklin at their head. This was a thunderſtroke to the ſupporters of the new doctrine.—— Meſmer himſelf refuſed to have any communication with the committee; but his moſt celebrated pupil Deſlon was leſs ſcrupulous, and explained the principles of his art in the following manner:

1. Animal magnetiſm is an univerſal fluid, conſtituting an abſolute plenum in nature, and the medium of all mutual influence between the celeſtial bodies and betwixt the earth and animal bodies.

2. It is the moſt ſubtile fluid in nature; capable of a flux and reflux, and of receiving, propagating, and continuing all kinds of motion.

3. The animal body is ſubjected to the influences of this fluid by means of the nerves, which are immediately affected by it.

4. The human body has poles and other properties analogous to the magnet.

5. The action and virtue of animal magnetiſm may be communicated from one body to another, whether animate or inanimate

6. It operates at a great diſtance without the intervention of any body.

7. It is increaſed and reflected by mirrors; communicated, propagated, and increaſed by ſound; and may be accumulated, concentrated, and tranſported.

8. Notwithſtanding the univerſality of this fluid, all animal bodies are not equally affected by it: on the other hand there are ſome, though but few in number, the preſence of which deſtroys all the effects of animal magnetiſm.

9. By means of this fluid nervous diſorders are cured immediately, and others mediately; and its virtues, in ſhort, extend to the univerſal cure and preſervation of mankind.

From this extraordinary theory, Meſmer, or M. Deſlon, had fabricated a paper, in which he ſtated that there was in nature but one diſeaſe and one cure, and that this cure was animal magnetiſm: and laſtly, M. Deſlon engaged, 1. To prove to the commiſſioners, that ſuch a thing as animal magnetiſm exiſted; 2. To prove the utility of it in the cure of diſeaſes; after which he was to communicate to them all that he knew upon the ſubject. The commiſſioners accordingly attended in the room were the patients underwent the magetical operations. The apparatus conſiſted of a circular platform made of oak, and raiſed about a foot and an half from the ground; which platform was called the *baquet*. At the top of it were a number of holes, in which were iron rods with moveable joints for the purpoſe of applying them to any part of the body. The patients were placed in a circle round, each touching an iron rod, which he could apply to any part of the body with pleaſure; they were joined to one another by a cord paſſing round their bodies, the deſign being to increaſe the effect by communication. In the corner of the room was a piano forte, on which ſome airs were played, occaſionally acompanied with a ſong. Each of the patients held in his hand an iron rod ten or twelve feet long; the intention of which, as Deſlon told the commiſſioners, was to concentrate the magnetiſm in its point, and thus to render its effects more ſenſible. Sound is another conductor of this magnetiſm; and in order to communicate the magnetiſm to the piano forte, nothing more is neceſſary than to bring the iron rod near it. Some magnetiſm is alſo furniſhed by the perſon who plays it: and this magnetiſm is tranſmitted to the patients by the ſounds. The internal part of the platform was ſaid to be ſo contrived as to concentrate the magnetiſm, and was the reſervoir whence the virtue diffuſed itſelf among the patients. Its ſtructure, however, is not mentioned; but the committee ſatisfied themſelves, by means of a needle and electrometer, that neither common magnetiſm nor electricity was concerned.

Beſides the different ways of receiving the magnetiſm already mentioned, viz. by the iron, cord, and piano forte, the patients alſo had it directly from the Doctor's finger, and a rod which he held in his hand, and which he carried about the face, head, or ſuch parts of the patient as were diſeaſed; obſerving always the direction of what he called the poles. The principal application of magnetiſm, however, was by preſſure of the hands or fingers on the hypochondria or lower regions of the ſtomach.

The effects of theſe operations upon Deſlon's patients were very different. Some felt nothing, neither had the magnetiſm any effect whatever upon them. Some ſpit, coughed, ſweat, and felt, or pretended to feel, extraordinary heats in different parts of the body. Many women, but very few men, had convulſions, which Deſlon called their criſis, &c.—The commiſſioners at laſt found that they could come to no ſatisfactory concluſion while they attended in this public way, and therefore determined to try the experiments themſelves privately. As the fluid itſelf, however, was totally imperceptible by any of the ſenſes, they could only aſcertain themſelves of its exiſtence by ultimately curing diſeaſes, or by obſervable effects upon the human body. Being well aſſured, however, that though many diſeaſes were cured, it would not amount to any proof of the exiſtence of animal magnetiſm, they determined to obſerve its effects on the animal œconomy. For this purpoſe they made the following experiments:

1. They tried it upon themſelves, and felt nothing.
2. Seven of Deſlon's patients were magnetiſed at Dr Franklin's houſe, four of whom felt nothing: three felt, or affected to feel ſomething.
3. Several perſons in a higher ſphere of life were magnetiſed, and felt nothing.
4. The commiſſioners, now determined to diſcover what ſhare imagination had in this buſineſs, blindfolded ſeveral of the common people, and made them ſometimes think that they were magnetiſed, at other times they magnetiſed them without letting them know that they did ſo: the conſequence was, that when they ſuppoſed themſelves magnetiſed, the patients likewiſe thought they felt ſomething, and *vice verſa.*
5. A magnetiſed tree was ſaid to produce convulſions; a young man, blindfolded, fell into convulſions when he imagined himſelf near the tree, though he was really at a conſiderable diſtance from it. Deſlon accounted for this on the principle of all trees being magnetic; but in this caſe, every one ſuſceptible of magnetiſm, would be ſeized with convulſions when he approached a tree. The ſame influence of imagination was obſerved in a woman accuſtomed to have convulſions when magnetiſed. They came on when nothing was done to her, on being told when blinded, that ſhe was magnetiſed.

Other inſtances are given, from which it was evident, either that the patients were impoſtors, or in ſuch a moſt wretched ſtate of debility both of mind and body, that the moſt trifling effects of the former had the moſt powerful effects on the latter. The commiſſioners therefore entirely diſapproved of the whole. The touch, imitation, and imagination, they concluded, were the great cauſes of the effects produced by Mr Deſlon's operations; and by means of theſe they ſuppoſed that convulſions, which in themſelves are a very violent diſorder, might be ſpread much farther than could be wiſhed, even through a whole city. It was obſerved that the operator ſometimes preſſed ſtrongly, and for a length of time, upon different parts of the body, particularly the hypochondria and pit of the ſtomach; and it is well known that a ſtrong preſſure on theſe parts will produce diſagreeable ſenſations in thoſe who enjoy perfect health.

It is needleſs to add more upon this ſubject, than that Meſmer complained of the report of the commiſſioners, petitioned parliament, was by them commanded to diſcover the myſteries of his doctrine; and that it is now exploded by every man of ſenſe.—The concluſion of the academicians concerning it was, that it is not entirely uſeleſs even to philoſophy; as it is one *fact* more to be conſigned to the hiſtory of the errors and illuſions of the human mind, and a ſignal inſtance of the power of imagination.

MAGNEIZ (Nicolas), a learned and laborious eccleſiaſtic, who died in the year 1749 at an advanced age. He is known by his excellent Latin dictionary, intitled *Novitius*, printed at Paris 1721, 2 vols 4to. Notwithſtanding the great utility of this dictionary to maſters, and the merited eſteem in which it is held, it has never undergone another edition; for in that which bears the date of 1733, there is no circumſtance of difference except the frontiſpiece. In this dictionary, beſides the words to be met with in the claſſics, we find all thoſe which occur in the Bible the breviary, and the eccleſiaſtical authors, the terms of art, the names of great men, heathen gods, biſhops, councils, hereſies, &c.; in ſhort, more than 6000 words which are not to be found in the common dictionaries.

MAGNIFYING, the making of objects appear larger than they would otherwiſe do; whence convex lenſes, which have the power of doing this, are called *magnifying glaſſes*. See OPTICS.

MAGNITUDE, whatever is made up of parts locally extended, or that has ſeveral dimenſions; as a line, ſurface, ſolid, &c.

MAGNOLIA, the LAUREL-LEAVED TULIP TREE, in botany: A genus of the polyginia order, belonging to the polyandria claſs of plants; and in the natural method ranking under the 52d order, *Coadnatæ*. The calyx is triphyllous; there are nine petals; the capſules bivalved and imbricated; the ſeeds pendulous, and in the form of a berry.

Species. 1. The glauca, or ſmall magnolia, is a native of Virginia, Carolina, and other parts of North America. In moiſt places it riſes from ſeven or eight to 15 or 16 feet high, with a ſlender ſtem. The wood is white and ſpongy, the bark ſmooth and of a greeniſh white colour; the branches garniſhed with thick ſmooth leaves, like thoſe of the bay; but of an oval ſhape, ſmooth on their edges, and white underneath. The flowers are produced at the extremities of the branches, are white, compoſed of ſix concave petals, and have an agreeable ſcent. After the flowers are paſt, the fruit increaſes in ſize till it becomes as large as a walnut with its cover; but of a conical ſhape, having many cells round the outſide, in each of which is a flat ſeed about the ſize of a ſmall kidney-bean. When ripe, the fruit is of a brown colour, the ſeeds are diſcharged from their cells, and hang by a ſlender thread. 2. The grandiflora, or great magnolia, is a native of Florida and South Carolina. It riſes to the height of 80 feet or more, with a ſtraight trunk upwards of two feet diameter, having a regular head. The leaves reſemble thoſe of the laurel, but are larger, and continue green throughout the year. The flowers are produced at the ends of the branches, and are of a purpliſh white colour. 3. The tripetala, or umbrella-tree, is a native of Carolina. It riſes, with a ſlender trunk, to the height of 16 or 20 feet; the wood is ſoft and ſpongy; the leaves remarkably large, and produced in horizontal circles, ſomewhat reſembling an umbrella, from whence the inhabitants of thoſe countries have given it this name. The flowers are compoſed of ten or eleven white petals, that hang down without any order. The leaves drop off at the beginning of winter. 4. The acuminata, with oval, ſpear-ſhaped, pointed leaves, is a native of the inland parts of North America. The leaves are near eight inches long, and five broad; ending in a point. The flowers come out early in the ſpring, and are compoſed of 12 white petals; the wood is of a fine grain, and an orange colour.

Culture, &c. All theſe ſpecies are propagated by ſeeds, which muſt be procured from the places were they grow naturally. They ſhould be put up in ſand, and ſent over as ſoon as poſſible; for if they are kept long out of the ground, they rarely grow.—The glauca generally grows in a poor ſwampy ſoil, or on wet meadows. The Engliſh and Swedes in Pennſylvania and New Jerſy call it *beaver-tree*, becauſe the root of it is the dainty of beavers, which are caught by its means. It drops its leaves early in autumn, though ſome of the young trees keep them all the winter. This tree is ſeldom found to the north of Pennſylvania, where it begins to flower about the end of May. The ſcent of its bloſſoms is exquiſite: for by it you can diſcover, within three quarters of an Engliſh mile, whether theſe little trees ſtand in the neighbourhood, provided the wind be not againſt it; for the whole air is filled with this ſweet and pleaſant odour. It is beyond deſcription agreeable to travel in the woods about that time, eſpecially towards night. They retain their flowers for three weeks, and even longer, according to the quality of the ſoil on which the trees ſtand; and during the whole time of their being in bloſſom, they ſpread their odoriferous exhalations. The berries likewiſe look very fine when they are ripe; for they have a rich red colour, and hang in bunches on ſlender ſtalks. The cough and other pectoral diſeaſes are cured by putting the berries into rum or brandy, of which a draught every morning may be taken: the virtues of this remedy were univerſally extolled, and even praiſed, for their ſalutary effects in conſumptions. The bark being put into brandy, or boiled in any other liquor, is ſaid not only to eaſe pectoral diſeaſes, but likewiſe to be of ſome ſervice againſt all internal pains and heat; and it was thought that a decoction of it could ſtop the dyſentery. Perſons who had caught cold boiled the branches of the beaver-tree in water, and drank it to their great relief. *Kalm.*

MAGNUS (John), archbiſhop of Upſal, was born at Lincopping in 1488. Being made apoſtolical nuncio, he uſed his utmoſt endeavours to prevent Guſtavus Vaſa from becoming king of Sweden, and the introduction of Lutheraniſm into his dominions; and ſpared no means to attain theſe ends. He died at Rome in 1545. He wrote a hiſtory of Sweden, and a hiſtory of the archbiſhops and biſhops of Upſal.

MAGNUS (Olaus), archbiſhop of Upſal in Sweden, ſucceeded his brother John Magnus in 1544 He appeared with great credit at the council of Trent in 1546, and ſuffered much afterwards for the Catholic religion. We have of his writing, A Hiſtory of the Manners, Cuſtoms, and Wars of the Northen Nations of Europe.

MAGNUS CAMPUS, (anc. geog.), a tract lying towards Scythopolis, or Bethſan in Gallilee, beyond which it extends into Samaria; Joſephus placing the common boundary between theſe two diſtricts, in the Campus Magnus. Called alſo *Eſdrelon*, (Judith); 30 miles long, and 18 broad; having Samaria with mount Ephraim to the ſouth, the lake Geneſareth to the eaſt, mount Carmel to the weſt, and Lebanon to the north.

MAGNUS *Portus*, (anc. geog.), a port of the Belgæ, in Britain, on the Channel. Now thought to be Portſmouth, in Hampſhire.—Another *Portus Magnus* of Bætica in Spain; a port to the eaſt of Abdera.

MAGO, the name of ſeveral Carthaginian generals. See CARTHAGE.

MAGO, (anc. geog.) a citadel and town of the Balearis Minor, or Minorca. Now Maon, or Mahon. E. long. 4° 6′. lat. 39° 5′.

MAGONTIACUM, MOGUNTIACUM, or *Mogontiacus*, truncated afterwards by the poets to Mogontia, Maguntia, and Moguntia: a town of Gallia Belgica. Now *Mentz*, capital of the electorate of that name; ſituated at the confluence of the Rhine and Maine. E. long 8°, lat. 50°.

MAGOPHONIA (formed from μαγος, "magus," and φονος, "ſlaughter"), the name of a feaſt among the ancient Perſians, held in memory of the expulſion of the Magians. The Magus Smerdis having uſurped the throne of Perſia, upon the death of Cambyſes, 521 years before Jeſus Chriſt, ſeven of the principal lords of the court conſpired to drive him out of it.—Their deſign was executed with good ſucceſs: Smerdis and his brother, another Magus, called Patizithes, were killed. Upon which the people alſo roſe, and put all the Magi to the ſword, inſomuch that there would not one have eſcaped, had not night come upon them. Darius, ſon of Hyſtaſpes, was then elected king; and, in memory of this maſſacre of the Magi, a feaſt was inſtituted, ſays Herodotus, called *Magophonia*. See MAGI.

MAGPY, in ornithology. See CORVUS.

MAHIE, the name given by the inhabitants of O-taheite, or George's iſland, to their bread-fruit when made into a kind of ſour paſte, which, in conſequence of having undergone a fermentation will keep a conſiderable time, and ſupply them with food when no ripe fruit is to be had. When therefore they ſee a great ſhew of new fruit on the trees, they ſtrip them all at once of their former crop, of which they make mahie. This *ſuccedaneum* for ripe bread-fruit is thus made. They gather the fruit before it be perfectly ripe, and laying it in heaps cover it cloſely with leaves In this ſtate it ferments, and becomes diſagreeably ſweet; the core is then taken out entire, and the reſt of the fruit thrown into a hole in their houſes, dug on purpoſe, and neatly lined in the bottom and ſides with graſs. The whole is then covered with leaves. and heavy ſtones are laid upon them. In this ſtate it undergoes a ſecond fermentation, and becomes ſour; after which it will ſuffer no change for many months. It is taken out of this hole as it is wanted for uſe, and being made into balls, it is wrapped up in leaves and baked, and thus dreſſed it will keep for five or ſix weeks. It is eaten, both cold and hot, and the natives of thoſe countries ſeldom make a meal without it; but to captain Cook and his company the taſte was as diſagreeable as that of a pickled olive generally is the firſt time it is eaten.

MAHO. See HIBISCUS.

MAHOGANY. See SWIETENIA.

MAHOMET, or MOHAMMED, ſtyled the *Impoſtor*, was born in the reign of Anuſhirwan the Juſt, emperor of Perſia, about the end of the 6th century of the Chriſtian æra. He came into the world under ſome diſadvantages. His father Abd'allah was a younger ſon of Abd'almotaleb; and dying very young, and in his father's lifetime, left his widow and infant-ſon in very mean circumſtances, his whole ſubſtance conſiſting but of five camels and one Ethiopian ſhe-ſlave. Abd'almotalleb was therefore obliged to take care of his grandchild Mahomet; which he not only did during his life, but at his death enjoined his eldeſt ſon Abu Taleb, who was brother to Abd'allah by the ſame mother, to provide for him for the future: which he very affectionately did, and inſtructed him in the buſineſs of a merchant, which he followed; and to that end he took him into Syria when he was but 13. He afterwards recommended him to Khadijah, a noble and rich widow, for her factor; in whoſe ſervice he behaved himſelf ſo well, that by making him her huſband ſhe ſoon raiſed him to an equality with the richeſt in Mecca.

After he began by this advantageous match to live at his eaſe, it was, that he formed the ſcheme of eſtabliſhing a new religion, or, as he expreſſed it, of replanting the only true and ancient one profeſſed by Adam, Noah, Abraham, Moſes, Jeſus, and all the prophets, by deſtroying the groſs idolatry into which the generality of his countrymen had fallen, and weeding out the corruptions and ſuperſtitions which the latter Jews and Chriſtians had, as he thought, introduced into their religion, and reducing it to its original purity, which conſiſted chiefly in the worſhip of one only God.

Before he made any attempt abroad, he rightly judged that it was neceſſary for him to begin with the converſion of his own houſehold. Having therefore retired with his family, as he had done ſeveral times before, to a cave in mount Hara, he there opened the ſecret of his miſſion to his wife Khadijah; and acquainted her that the angel Gabriel had juſt before appeared to him, and told him that he was appointed the apoſtle of God: he alſo repeated to her a paſſage which he pretended had been revealed to him by the miniſtry of the angel, with thoſe other circumſtances of this firſt appearance, which are related by the Mahometan writers. Khadijah received the news with great joy; ſwearing by him in whoſe hands her ſoul was, that ſhe truſted he would be the prophet of his nation; and immediately communicated what ſhe had heard to her couſin Warakah Ebn Nawfal, who, being a Chriſtian, could write in the Hebrew character, and was tolerably well verſed in the ſcriptures; and he as readily came into her opinion, aſſuring her that the ſame angel who had formerly appeared unto Moſes was now ſent to Mahomet. The firſt overture the prophet made was in the month of Ramadan, in the 40th year of his age, which is therefore uſually called the year of his miſſion.

Encouraged by ſo good a beginning, he reſolved to proceed, and try for ſome time what he could do by private perſuaſion, not daring to hazard the whole affair by expoſing it too ſuddenly to the public. He ſoon made proſelytes of thoſe under his own roof, viz. his wife Khadijah, his ſervant Zeid Ebn Haretha, to whom he gave his freedom on that occaſion, (which afterward became a rule to his followers), and his couſin and pupil Ali, the ſon of Abu Taleb, though then very young: but this laſt, making no account of the other two, uſed to ſtyle himſelf the *firſt of believers*. The next perſon Mahomet applied to was Abd'allah Ebn Abi Kohafa, ſurnamed *Abu Becr*, a man of great authority among the Koreiſh, and one whoſe intereſt he well knew would be of great ſervice to him; as it ſoon appeared: for Abu Becr, being gained over, prevailed alſo on Othman Ebn Affan, Abd'alraham Ebn Awf, Saad Ebn Abbi Wakkas, al Zobeir Ebn al Awam, and Telha Ebn Obeid'allah, all principal men of Mecca, to follow his example. Theſe men were the ſix chief companions, who with a few more, were converted in the ſpace of three years: at the end of which, Mahomet having, as he hoped, a ſufficient intereſt to ſupport him, made his miſſion no longer a ſecret, but gave out that God had commanded him to admoniſh his near relations; and in order to do it with more convenience and proſpect of ſucceſs, he directed Ali to prepare an entertainment, and invite the ſons and deſcendants of Abd'almotaleb, intending then to open his mind to them. This was done, and about 40 of them came; but Abu Laheb, one of his uncles, making the company break up before Mahomet had an opportunity of ſpeaking, obliged him to give them a ſecond invitation the next day; and when they were come, he made them the following ſpeech: "I know no man in all Arabia who can offer his kindred a more excellent thing than I now do you; I offer you happineſs both in this life, and in that which is to come; God Almighty hath commanded me to call you unto him: Who, therefore, among you will be aſſiſtant to me herein, and become my brother and my vicegerent?" All of them heſitating, and declining the matter, Ali at length roſe up, and declared that he would be his aſſiſtant; and vehemently threatened thoſe who ſhould oppoſe him. Mahomet upon this embraced Ali with great demonſtrations of affection, and deſired all who were preſent to hearken to and obey him as his deputy; at which the company broke out into a great laughter, telling Abu Taleb that he muſt now pay obedience to his ſon.

This repulſe, however, was ſo far from diſcouraging Mahomet, that he began to preach in public to the people; who heard him with ſome patience till he came to upbraid them with the idolatry, obſtinacy, and perverſeneſs of themſelves and their fathers: which ſo highly provoked them, that they declared themſelves his enemies; and would ſoon have procured his ruin, had he not been protected by Abu Taleb. The chief of the Koreiſh warmly ſolicited this perſon to deſert his nephew, making frequent remonſtrances againſt the innovations he was attempting; which proving ineffectual, they at length threatened him with an open rupture, if he did not prevail on Mahomet to deſiſt. At this Abu Taleb was ſo far moved, that he earneſtly diſſuaded his nephew from purſuing the affair any farther, repreſenting the great danger he and his friends muſt otherwiſe run. But Mahomet was not to be intimidated; telling his uncle plainly, *that if they ſet the ſun againſt him on his right hand, and the moon on his left, he would not leave his enterprize*: and Abu Taleb, ſeeing him ſo firmly reſolved to proceed, uſed no further arguments, but promiſed to ſtand by him againſt all his enemies.

The Koreiſh, finding they could prevail neither by fair words or menaces, tried what they could do by force and ill-treatment; uſing Mahomet's followers ſo very injuriouſly, that it was not ſafe for them to continue at Mecca any longer: whereupon Mahomet gave leave to ſuch of them as had not friends to protect them to ſeek for refuge elſewhere. And accordingly in the fifth year of the prophet's miſſion, 16 of them, four of whom were women, fled into Ethiopia; and among them Othman Ebn Affan and his wife Rakiah, Mahomet's daughter. This was the firſt flight; but afterwards ſeveral others followed them, retiring one after another, to the number of 83 men and 18 women, beſides children. Theſe refugees were kindly received by the Najaſhi, or king of Ethiopia; who refuſed to deliver them up to thoſe whom the Koreiſh ſent to demand them, and, as the Arab writers unanimouſly atteſt, even profeſſed the Mahometan religion.

In the ſixth year of his miſſion, Mahomet had the pleaſure of ſeeing his party ſtrengthened by the converſion of his uncle Hamza, a man of great valour and merit; and of Omar Ebn al Kattab, a perſon highly eſteemed, and once a violent oppoſer of the prophet. As perſecution generally advances rather than obſtructs the ſpreading of a religion, Iſlamiſm made ſo great a progreſs among the Arab tribes, that the Koreiſh, to ſuppreſs it effectually if poſſible, in the ſeventh year of Mahomet's miſſion, made a ſolemn league or covenant againſt the Haſhemites and the family of Abd'almotaleb, engaging themſelves to contract no marriages with any of them, and to have no communication with them; and, to give it the greater ſanction, reduced it into writing, and laid it up in the Caaba. Upon this the tribe became divided into two factions; and the family of Haſhem all repaired to Abu Taleb, as their head; except only Abd'al Uzza, ſurnamed *Abu Laheb*, who, out of inveterate hatred to his nephew and his doctrine, went over to the oppoſite party, whoſe chief was Abu Sofian Ebn Harb, of the family of Ommeya.

The families continued thus at variance for three years; but in the tenth year of his miſſion, Mahomet told his uncle Abu Taleb, that God had manifeſtly ſhowed his diſapprobation of the league which the Koreiſh had made againſt them, by ſending a worm to eat out every word of the inſtrument except the name of *God*. Of this accident Mahomet had probably ſome private notice: for Abu Taleb went immediately to the Koreiſh, and acquainted them with it; offering, if it proved falſe, to deliver his nephew up to them; but in caſe it were true, he inſiſted that they ought to lay aſide their animoſity, and annul the league they had made againſt the Haſhemites. To this they acquieſced; and going to inſpect the writing, to their great aſtoniſhment found it to be as Abu Taleb had ſaid; and the league was thereupon declared void.

In the ſame year Abu Taleb died, at the age of above fourſcore; and it is the general opinion that he died an infidel: though others ſay, that when he was at the point of death he embraced Mahometaniſm; and produce ſome paſſages out of his poetical compoſitions to confirm their aſſertion. About a month, or, as ſome write, three days after the death of this great benefactor and patron, Mahomet had the additional mortification to loſe his wife Khadijah, who had ſo generouſly made his fortune. For which reaſon this year is called the *year of mourning*.

On the death of theſe two perſons, the Koreiſh began to be more troubleſome than ever to their prophet, and eſpecially ſome who had formerly been his intimate friends; inſomuch that he found himſelf obliged to ſeek for ſhelter elſewhere, and firſt pitched upon Tayef, about 60 miles eaſt from Mecca, for the place of his retreat. Thither therefore he went, accompanied by his ſervant Zeid, and applied himſelf to two of the chief of the tribe of Thakif who were the inhabitants of that place; but they received him very coldly. However, he ſtaid there a month; and ſome of the more conſiderate and better ſort of men treated him with a little reſpect: but the ſlaves and inferior people at length roſe againſt him; and bringing him to the wall of the city, obliged him to depart and return to Mecca, where he put himſelf under the protection of Al Motaam Ebn Adi.

This repulſe greatly diſcouraged his followers. However, Mahomet was not wanting to himſelf; but boldly continued to preach to the public aſſemblies at the pilgrimage, and gained ſeveral proſelytes; and among them ſix of the inhabitants of Yathreb of the Jewiſh tribe of Khazraj; who, on their return home, failed not to ſpeak much in commendation of their new religion, and exhorted their fellow citizens to embrace the ſame.

In the 12th year of his miſſion it was that Mahomet gave out that he had made his night-journey from Mecca to Jeruſalem, and thence to heaven, ſo much ſpoken of by all that write of him. Dr Prideaux thinks he invented it, either to anſwer the expectations of thoſe who demanded ſome miracle as a proof of his miſſion; or elſe, by pretending to have converſed with God, to eſtabliſh the authority of whatever he ſhould think fit to leave behind by way of oral tradition, and make his ſayings to ſerve the ſame purpoſe as the oral law of the Jews. But it does not appear that Mahomet himſelf ever expected ſo great a regard ſhould be paid to his ſayings, as his followers have ſince done; and ſeeing he all along diſclaimed any power of performing miracles, it ſeems rather to have been a fetch of policy to raiſe his reputation, by pretending to have actually converſed with God in heaven, as Moſes had heretofore done in the mount, and to have received ſeveral inſtitutions immediately from him, whereas before he contented himſelf with perſuading them that he had all by the miniſtry of Gabriel.

However, this ſtory ſeemed ſo abſurd and incredible, that ſeveral of his followers left him upon it; and had probably ruined the whole deſign, had not Abu Becr vouched for his veracity, and declared, that, if Mahomet affirmed it to be true, he verily believed the whole. Which happy incident not only retrieved the prophet's credit, but increaſed it to ſuch a degree, that he was ſecure of being able to make his diſciples ſwallow whatever he pleaſed to impoſe on them for the future. And this fiction, notwithſtanding its extravagance, was one of the moſt artful contrivances Mahomet ever put in practice, and what chiefly contributed to the raiſing of his reputation to that great height to which it afterwards arrived.

In this year, called by the Mahometans the *accepted year*, 12 men of Yathreb or Medina, of whom 10 were of the tribe of Khazraj, and the other two of that of Aws, came to Mecca, and took an oath of fidelity to Mahomet at al Akaba, a hill on the north of that city. This oath was called the *womens oath*; not that any women were preſent at this time, but becauſe a man was not thereby obliged to take up arms in defence of Mahomet or his religion; it being the ſame oath that was afterwards exacted of the women, the form of which we have in the Koran, and is to this effect: *viz.* That they ſhould renounce all idolatry; and they ſhould not ſteal, nor commit fornication, nor kill their children (as the Pagan Arabs uſed to do when they apprehended they ſhould not be able to maintain them), nor forge calumnies; and that they ſhould obey the prophet in all things that were reaſonable. When they had ſolemnly engaged to all this, Mahomet ſent one of his diſciples, named *Maſab Ebn Omair*, home with them, to inſtruct them more fully in the grounds and ceremonies of his new religion.

Maſab being arrived at Medina, by the aſſiſtance of thoſe who had been formerly converted, gained ſeveral proſelytes, particularly Oſaid Ebn Hodeira, a chief man of the city, and Saad Ebn Moadh, prince of the tribe of Aws; Mahometaniſm ſpreading ſo faſt, that there was ſcarce a houſe wherein there were not ſome who had embraced it.

The next year, being the 13th of Mahomet's miſſion, Maſab returned to Mecca, accompanied by 73 men and two women of Medina who had profeſſed Iſlamiſm, beſides ſome others who were as yet unbelievers. On their arrival, they immediately ſent to Mahomet, and offered him their aſſiſtance, of which he was now in great need; for his adverſaries were by this time grown ſo powerful in Mecca, that he could not ſtay there much longer without eminent danger. Wherefore he accepted their propoſal, and met them one night, by appointment, at al Akaba abovementioned, attended by his uncle al Abbas; who, though he was not then a believer, wiſhed his nephew well, and made a ſpeech to thoſe of Medina; wherein he told them, that as Mahomet was obliged to quit his native city, and ſeek an aſylum elſewhere, and they had offered him their protection, they would do well not to deceive him; that if they were not firmly reſolved to defend, and not betray him, they had better declare their minds, and let him provide for his ſafety in ſome other manner. Upon their proteſting their ſincerity, Mahomet ſwore to be faithful to them, on condition that they ſhould protect him againſt all inſults as heartily as they would their own wives and families. They then aſked him what recompence they were to expect if they ſhould happen to be killed in his quarrel; he anſwered, Paradiſe. Whereupon they pledged their faith to him, and ſo returned home; after Mahomet had choſen 12 out of their number, who were to have the ſame authority among them as the 12 apoſtles of Chriſt had among his diſciples.

Hitherto Mahomet had propagated his religion by fair means; ſo that the whole ſucceſs of this enterpriſe, before his flight to Medina, muſt be attributed to perſuaſion only, and not to compulſion. For before this ſecond oath of fealty or inauguration at al Akaba, he had no permiſſion to uſe any force at all; and in ſeveral places of the Koran, which he pretended were revealed during his ſtay at Mecca, he declares his buſineſs was only to preach and admoniſh; that he had no authority to compel any perſon to embrace his religion; and that, whether people believe or not, was none of his concern, but belonged ſolely unto God. And he was ſo far from allowing his followers to uſe force, that he exhorted them to bear patiently thoſe injuries which were offered them on account of their faith; and, when perſecuted himſelf, choſe rather to quit the place of his birth and retire to Medina, than to make any reſiſtance. But this great paſſiveneſs and moderation ſeem entirely owing to his want of power, and the great ſuperiority of his oppoſers for the firſt 12 years of his miſſion; for no ſooner was he enabled, by the aſſiſtance of thoſe of Medina, to make head againſt his enemies, than he gave out, that God had allowed him and his followers to defend themſelves againſt the infidels; and at length, as his forces increaſed, he pretended to have the divine leave even to attack them; and to deſtroy idolatry, and ſet up the true faith by the ſword; finding, by experience, that his deſigns would otherwiſe proceed very ſlowly, if they were not utterly overthrown; and knowing, on the other hand, that innovators, when they depend ſolely on their own ſtrength, and can compel, ſeldom run any riſk; from whence, [ſays Machiavel, it follows, that all the armed prophets have ſucceeded, and the unarmed ones have failed. Moſes, Cyrus, Theſeus, and Romulus, would not have been able to eſtabliſh the obſervance of their inſtitutions for any length of time, had they not been armed. The firſt paſſage of the Koran which gave Mahomet the permiſſion of defending himſelf by arms, is ſaid to have been that in the 22d chapter; after which a great number to the ſame purpoſe were revealed.

That Mahomet had a right to take up arms for his own defence againſt his unjuſt perſecutors, may perhaps be allowed; but whether he ought afterwards to have made uſe of that means for the eſtabliſhing of his religion, it is not ſo eaſy to determine. How far the ſecular power may or ought to interpoſe in affairs of this nature, mankind are not agreed. The method of converting by the ſword gives no very favourable idea of the faith which is ſo propagated, and is diſallowed by every body in thoſe of another religion, though the ſame perſons are willing to admit of it for the advancement of their own: ſuppoſing that, though a falſe religion ought not to be eſtabliſhed by authority, yet a true one may; and accordingly force is almoſt as conſtantly employed in theſe caſes by thoſe who have the power in their hands, as it is conſtantly complained of by thoſe who ſuffer the violence. It is certainly one of the moſt convincing proofs that Mahometaniſm was no other than a human invention, that it owed its progreſs and eſtabliſhment almoſt entirely to the ſword: and it is one of the ſtrongeſt demonſtrations of the divine original of Chriſtianity, that it prevailed againſt all the force and powers of the world by the dint of its own truth, after having ſtood the aſſaults of all manner of perſecutions, as well as other oppoſitions, for 300 years together, and at length made the Roman emperors themſelves ſubmit thereto: after which time, indeed, this proof ſeems to fail, Chriſtianity being then eſtabliſhed, and Paganiſm aboliſhed, by public authority, which has had great influence in the propagation of the one and deſtruction of the other ever ſince. But to return.

Mahomet, having provided for the ſecurity of his companions as well as his own, by the league offenſive and defenſive which he had now concluded with thoſe of Medina, directed them to repair thither, which they accordingly did; but himſelf with Abu Becr and Ali ſtaid behind, having not yet received the divine permiſſion, as he pretended, to leave Mecca. The Koreiſh fearing the conſequence of this new alliance, began to think it abſolutely neceſſary to prevent Mahomet's eſcape to Medina; and having held a council thereon, after ſeveral milder expedients had been rejected, they came to a reſolution that he ſhould be killed; and agreed that a man ſhould be choſen out of every tribe for the execution of this deſign; and that each man ſhould have a blow at him with his ſword, that the guilt of his blood might fall equally on all the tribes, to whoſe united power the Haſhemites were much inferior, and therefore durſt not attempt to revenge their kinſman's death.

This conſpiracy was ſcarce formed, when, by ſome means or other, it came to Mahomet's knowledge; and he gave out that it was revealed to him by the angel Gabriel, who had now ordered him to retire to Medina. Whereupon, to amuſe his enemies, he directed Ali to lie down in his place, and wrap himſelf up in his green cloak, which he did; and Mahomet eſcaped miraculouſly, as they pretend, to Abu Becr's houſe, unperceived by the conſpirators, who had already aſſembled at the prophet's door. They, in the mean time, looking through the crevice, and ſeeing Ali, whom they took to be Mahomet himſelf, aſleep, continued watching there till morning, when Ali aroſe, and they found themſelves deceived.

From Abu Becr's houſe Mahomet and he went to a cave in mount Thur, to the ſouth-eaſt of Mecca, accompanied only by Amer Ebn Foheirah, Abu Becr's ſervant, and Abd'alla Ebn Oreitah, an idolater whom they had hired for a guide. In this cave they lay hid three days to avoid the ſearch of their enemies; which they very narrowly eſcaped, and not without the aſſiſtance of more miracles than one: for ſome ſay that the Koreiſh were ſtruck with blindneſs, ſo that they could not find the cave; others, that after Mahomet and his companions were got in, two pigeons laid their eggs at the entrance, and a ſpider covered the mouth of the cave with her web, which made them look no farther. Abu Becr, ſeeing the prophet in ſuch imminent danger, became very ſorrowful; whereupon Mahomet comforted him with theſe words, recorded in the Koran, *Be not grieved, for God is with us.* Their enemies being retired, they left the cave, and ſet out for Medina, by a by-road; and having fortunately, or, as the Mahometans tell us, miraculouſly eſcaped ſome who were ſent to purſue them, arrived ſafely at that city; whither Ali followed them in three days, after he had ſettled ſome affairs at Mecca.

The firſt thing Mahomet did after his arrival at Medina, was to build a temple for his religious worſhip, and a houſe for himſelf, which he did on a parcel of ground which had before ſerved to put camels in, or, as others tell us, for a burying-ground, and belonged to Shal and Soheil, the ſons of Amru, who were orphans. This action Dr Prideaux exclaims againſt, repreſenting it as a flagrant inſtance of injuſtice; for that, ſays he, he violently diſpoſſeſſed theſe poor orphans, the ſons of an inferior artificer (whom the author he quotes calls a *carpenter*), of this ground, and ſo founded the firſt fabric of his worſhip with the like wickedneſs as he did his religion. But, to ſay nothing of the improbability that Mahomet ſhould act in ſo impolitic a manner at his firſt coming, the Mahometan writers ſet this affair in a quite different light: one tells us he treated with the lads about the price of the ground, but they deſired he would accept it as a preſent: however, as hiſtorians of good credit aſſure us, he actually bought it; and the money was paid by Abu Becr. Beſides, had Mahomet accepted it as a peſent, the orphans were in circumſtances ſufficient to have afforded it: for they were of a very good family, of the tribe of Najjer, one of the moſt illuſtrious among the Arabs; and not the ſons of a carpenter, as Dr Prideaux's author writes, who took the word *Najjer*, which ſignifies "a carpenter," for an appellative, whereas it is a proper name.

Mahomet, being ſecurely ſettled at Medina, and able not only to defend himſelf againſt the inſults of his enemies, but to attack them, began to ſend out ſmall parties to make repriſals on the Koreiſh; the firſt party conſiſting of no more than nine men, who intercepted and plundered a caravan belonging to that tribe, and in the action took two priſoners. But what eſtabliſhed his affairs very much, and was the foundation on which he built all his ſucceeding greatneſs, was the gaining of the battle of Bedr, which was fought in the ſecond year of the Hegira, and is ſo famous in the Mahometan hiſtory. Some reckon no leſs than 27 expeditions wherein Mahomet was perſonally preſent, in nine of which he gave battle, beſides ſeveral other expeditions in which he was not preſent. His forces he maintained partly by the contributions of his followers for this purpoſe, which he called by the name of *zacat* or *alms*, and the paying of which he very artfully made one main article of his religion; and partly by ordering a fifth part of the plunder to be brought into the public treaſury for that purpoſe, in which matter he likewiſe pretended to act by the divine direction.

In a few years, by the ſucceſs of his arms (notwithſtanding he ſometimes came off by the worſt) he conſiderably raiſed his credit and power. In the ſixth year of the Hegira he ſet out with 1400 men to to viſit the temple of Mecca, not with any intent of committing hoſtilities, but in a peaceable manner. However, when he came to al Hodeibiya, which is ſituated partly within and partly without the ſacred territory, the Koreiſh ſent to let him know that they would not permit him to enter Mecca, unleſs he forced his way; whereupon he called his troops about him, and they all took a ſolemn oath of fealty or homage to him, and he reſolved to attack the city; but thoſe of Mecca ſending Arwa Ebn Maſud, prince of the tribe of Thakif, as their ambaſſador, to deſire peace, a truce was concluded between them for ten years, by which any perſon was allowed to enter into league either with Mahomet, or with the Koreiſh, as he thought fit.

It may not be improper, in order to ſhow the inconceivable veneration and reſpect the Mahometans by this time had for their prophet, to mention the account which the abovementioned ambaſſador gave the Koreiſh, at his return, of their behaviour. He ſaid he had been at the courts both of the Roman emperor and of the king of Perſia, and never ſaw any prince ſo highly reſpected by his ſubjects as Mahomet was by his companions: for, whenever he made the ablution, in order to ſay his prayers, they ran and catched the water that he had uſed; and whenever he ſpit they immediately licked it up, and gathered every hair that fell from him with great ſuperſtition.

In the ſeventh year of the Hegira, Mahomet began to think of propagating his religion beyond the bounds of Arabia; and ſent meſſengers to the neighbouring princes, with letters to invite them to Mahometiſm. Nor was this project without ſome ſucceſs. Khoſru Parviz, then king of Perſia, received his letter with great diſdain, and tore it in a paſſion, ſending away the meſſenger very abruptly; which when Mahomet heard, he ſaid *God ſhall tear his kingdom.* And ſoon after a meſſenger came to Mahomet from Badhon king of Yaman, who was a dependent on the Perſians, to acquaint him that he had received orders to ſend him to Khoſru. Mahomet put off his anſwer till the next morning, and then told the meſſenger it had been revealed to him that night that Khoſru was ſlain by his ſon Shiruyeh; adding, that he was well aſſured his new religion and empire ſhould riſe to as great a height as that of Khoſru; and therefore bid him adviſe his maſter to embrace Mahometiſm. The meſſenger being returned, Badhan in a few days received a letter from Shiruyeh, informing him of his father's death, ordering him to give the prophet no further diſturbance. Whereupon Badhan and the Perſians with him turned Mahometans.

The emperor Heraclius, as the Arabian hiſtorians aſſure us, received Mahomet's letter with great reſpect, laying it on his pillow, and diſmiſſed the bearer honourably. And ſome pretend that he would have profeſſed this new faith, had he not been afraid of loſing his crown.

Mahomet wrote to the ſame effect to the king of Ethiopia, though he had been converted before according to the Arab writers; and to Mokawkas, governor of Egypt, who gave the meſſenger a very favourable reception, and ſent ſeveral valuable preſents to Mahomet, and among the reſt two girls, one of which, named Mary, became a great favourite with him. He alſo ſent letters of the like purport to ſeveral Arab princes: particularly one to al Hareth Ebn Abi Shamer king of Ghaſſean, who returning for anſwer that he would go to Mahomet himſelf, the prophet ſaid, *may his kingdom periſh;* another to Hawdha Ebn Ali, king of Yamama, who was a Chriſtian, and, having ſome time before profeſſed Iſlamiſm, had lately returned to his former faith; this prince ſent back a very rough anſwer, upon which Mahomet curſing him, he died ſoon after: and a third to al Mondar Ebn Sawa, king of Bahrein, who embraced Mahometiſm, and all the Arabs of that country followed his example.

The eight year of the Hegira was a very fortunate year to Mahomet. In the beginning of it, Khaled Ebn al Walid and Amru Ebn al As, both excellent ſoldiers, the firſt of whom afterwards conquered Syria and other countries, and the latter Egypt, became proſelytes to Mahometiſm. And ſoon after the prophet ſent 3000 men againſt the Grecian forces, to revenge the death of one of his ambaſſadors, who, being ſent to the governor of Boſra on the ſame errand as thoſe who went to the abovementioned princes, was ſlain by an Arab, of the tribe of Ghaſſan, at Muta, a town in the territory of Balka in Syria, about three days journey eaſtward from Jeruſalem, near which town they encountered. The Grecians being vaſtly ſuperior in number (for, including the auxiliary Arabs, they had an army of 100,000 men, the Mahometans were repulſed in the firſt attack, and loſt ſucceſſively three of their generals, viz. Zeid Ebn. Haretha Mahomet's freedman, Jaafar the ſon of Abu Taleb, and Abdallah Ebn Rawaha: but Khaled Ebn al Walid ſucceeding to the command, overthrew the Greeks with a great ſlaughter, and brought away abundance of rich ſpoil; on occaſion of which action Mahomet gave him the title of *Seif min ſoyuf Allah,* "one of the ſwords of God."

In this year alſo Mahomet took the city of Mecca, the inhabitants whereof had broken the truce concluded on two years before. For the tribe of Becr, who were confederates with the Koreiſh, attacking thoſe of Khozaah, who were allies of Mahomet, killed ſeveral of them, being ſupported in the action by a party of the Koreiſh themſelves. The conſequence of this violation was ſoon apprehended; and Abu Soſian himſelf made a journey to Medina on purpoſe to heal the breach and renew the truce: but in vain; for Mahomet, glad of this opportunity, refuſed to ſee him: whereupon he applied to Abu Becr and Ali; but they giving him no anſwer, he was obliged to return to Mecca as he came.

Mahomet immediately gave orders for preparations to be made, that he might ſurpriſe the Meccans while they were unprovided to receive him: in a little time he began his march thither: and by that time he came near the city, his forces were increaſed to 10,000 men. Thoſe of Mecca, being not in a condition to defend themſelves againſt ſo formidable an army, ſurrendered at diſcretion; and Abu Soſian ſaved his life by turning Mahometan. About 28 of the idolaters were killed by a party under the command of Khaled; but this happened contrary to Mahomet's orders, who, when he entered the town, pardoned all the Koreiſh on their ſubmiſſion, except only ſix men and four women, who were more obnoxious than ordinary (ſome of them having apoſtatiſed), and were ſolemnly proſcribed by the prophet himſelf; but of theſe no more than three men and one woman were put to death, the reſt obtaining pardon on their embracing Mahometiſm, and one of the women making her eſcape.

The remainder of this year Mahomet employed in deſtroying the idols in and round Mecca, ſending ſeveral of his generals on expeditions for that purpoſe, and to invite the Arabs to Iſlamiſm: wherein it is no wonder if they now met with ſucceſs.

The next year, being the ninth of the Hegira, the Mahometans call *the year of embaſſies*: for the Arabs had been hitherto expecting the iſſue of the war between Mahomet and the Koreiſh: but, ſo ſoon as that tribe, the principal of the whole nation, and the genuine deſcendants of Iſhmael, whoſe prerogatives none offered to diſpute, had ſubmitted, they were ſatisfied that it was not in their power to oppoſe Mahomet; and therefore began to come in to him in great numbers, and to ſend embaſſies to make their ſubmiſſions to him, both to Mecca, while he ſtaid there, and alſo to Medina, whether he returned this year. Among the reſt, five kings of the tribe of Hamyar profeſſed Mahometiſm, and ſent ambaſſadors to notify the ſame.

In the 10th year, Ali was ſent into Yaman to propagate the Mahometan faith there; and, as it is ſaid, converted the whole tribe of Hamdan in one day. Their example was quickly followed by all the inhabitants of that province, except only thoſe of Najran, who, being Chriſtians, choſe rather to pay tribute.

Thus was Mahometiſm eſtabliſhed, and idolatry rooted out, even in Mahomet's lifetime (for he died the next year), throughout all Arabia, except only Yamama, where Moſeilama, who ſet up alſo for a prophet as Mahomet's competitor, had a great party, and was not reduced till the kalifat of Abu Becr: and the Arabs being then united in one faith, and under one prince, found themſelves in a condition of making thoſe conqueſts which extended the Mahometan faith over ſo great a part of the world.

Mahomet, the name of ſeveral emperors of the Turks; of whom the moſt celebrated is,

Mahomet II. ſurnamed *the Great*, their ſeventh ſultan. See Turkey.

He was born at Adrianople the 24th of March 1430; and is to be remembered chiefly by us for taking Conſtantinople in 1453, and thereby driving many learned Greeks into the Weſt, which was a great cauſe of the reſtoration of learning in Europe, as the Greek literature was then introduced there. He was one of the greateſt men upon record, with regard to the qualities neceſſary to a conqueror: for he conquered two empires, twelve kingdoms, and two hundred conſiderable cities. He was very ambitious of the title of Great, and the Turks gave it him; even the Chriſtians have not diſputed it with him; for he was the firſt of the Ottoman emperors whom the Weſtern nations dignified with the title of Grand Seignior or Great Turk, which poſterity has preſerved to his deſcendants. Italy had ſuffered greater calamities, but ſhe had never felt a terror equal to that which this ſultan's victories imprinted. The inhabitants ſeemed already condemned to wear the turban; it is certain, that pope Sixtus IV. repreſented to himſelf Rome as already involved in the dreadful fate of Conſtantinople; and thought of nothing but eſcaping into Provence, and once more transferring the holy ſee to Avignon. Accordingly, the news of Mahomet's death, which happened the 3d of May 1481, was received at Rome with the greateſt joy that ever was beheld there. Sixtus cauſed all the churches to be thrown open, made the tradeſpeople leave off their work, ordered a feaſt of three days, with public prayers and proceſſions, commanded a diſcharge of the whole artillery of the caſtle of St Angelo all that time, and put a ſtop to his journey to Avignon.

He appears to be the firſt ſultan who was a lover of arts and ſciences; and even cultivated polite letters. He often read the Hiſtory of Auguſtus, and the other Cæſars; and he peruſed thoſe of Alexander, Conſtantine, and Theodoſius, with more than ordinary pleaſure, becauſe theſe had reigned in the ſame country with himſelf. He was fond of painting, muſic, and ſculpture; and he applied himſelf to the ſtudy of agriculture. He was much addicted to aſtrology; and uſed to encourage his troops by giving out, that the motion and influence of the heavenly bodies promiſed him the empire of the world. Contrary to the genius of his country, he delighted ſo much in the knowledge of foreign languages, that he not only ſpoke the Arabian, to which the Turkiſh laws, and the religion of their legiſlator Mahomet, are appropriated, but alſo the Perſian, the Greek, and the French, that is, the corrupted Italian. Landin, a knight of Rhodes, collected ſeveral letters which this ſultan wrote in the Syriac, Greek, and Turkiſh languages, and tranſlated them into Latin. Where the originals are, nobody knows; but the tranſlation has been publiſhed ſeveral times; as at Lyons 1520, in 4to; at Baſil 1554, 12mo; in a collection publiſhed by Oporinus, at Marpurg 1604, in 8vo; and at Leipſic 1690, in 12mo. Melchoir Junius, profeſſor of eloquence at Straſburg, publiſhed at Montbeliard, 1595, a collection of letters, in which there are three written by Mahomet II. to Scanderbeg. One cannot diſcover the leaſt air of Turkiſh ferocity in theſe letters: they are written in as civil terms, and as obliging a manner,

ner, as the moſt polite prince in Chriſtendom could have written.

MAHOMETANISM, or MAHOMETISM, the ſyſtem of religion broached by Mahomet, and ſtill adhered to by his followers. See MAHOMET, and ALCORAN.

Mahometaniſm is profeſſed by the Turks, Perſians, and ſeveral nations among the Africans, and many among the Eaſt-Indians.

The Mahometans divide their religion into two general parts, faith and practice: of which the firſt is divided into ſix diſtinct branches; Belief in God, in his angels, in his ſcriptures, in his prophets, in the reſurrection and final judgment, and in God's abſolute decrees. The points relating to practice are, Prayer, with waſhings, &c. alms, faſting, pilgrimage to Mecca, and circumciſion.

I. Of the Mahometan *Faith.*] 1. That both Mahomet, and thoſe among his followers who are reckoned orthodox, had and continue to have juſt and true notions of God and his attributes, appears ſo plain from the Koran itſelf, and all the Mahometan divines, that it would be loſs of time to refute thoſe who ſuppoſe the God of Mahomet to be different from the true God, and only a fictitious deity or idol of his own creation.

2. The exiſtence of angels, and their purity, are abſolutely required to be believed in the Koran; and he is reckoned an infidel who denies there are ſuch beings, or hates any of them, or aſſerts any diſtinction of ſexes among them. They believe them to have pure and ſubtile bodies, created of fire; that they neither eat nor drink, nor propagate their ſpecies; that they have various forms and offices, ſome adoring God in different poſtures, others ſinging praiſes to him, or interceding for mankind. They hold, that ſome of them are employed in writing down the actions of men; others in carrying the throne of God, and other ſervices.

The four angels, whom they look on as more eminently in God's favour, and often mention on account of the offices aſſigned them, are, Gabriel, to whom they give ſeveral titles, particularly thoſe of the *holy ſpirit*, and the *angel of revelations*, ſuppoſing him to be honoured by God with greater confidence than any other, and to be employed in writing down the divine decrees; Michael, the friend and protector of the Jews; Azrael, the *angel of death*, who ſeparates mens ſouls from their bodies; and Iraſil, whoſe office it will be to ſound the trumpet at the reſurrection. The Mahometans alſo believe, that two guardian angels attend on every man, to obſerve and write down his actions, being changed every day, and therefore called *al Moakkibat*, or "the angels who continually ſucceed one another."

The devil, whom Mahomet names *Eblis*, from his *deſpair*, was once one of thoſe angels who are neareſt to God's preſence, called *Azazil;* and fell, according to the doctrine of the Koran, for refuſing to pay homage to Adam at the command of God.

Beſides angels, and devils, the Mahometans are taught by the Koran to believe an intermediate order of creatures, which they call *jin* or *genii*, created alſo of fire, but of a groſſer fabric than angels, ſince they eat and drink, and propagate their ſpecies, and are ſubject to death. Some of theſe are ſuppoſed to be good and others bad, and capable of future ſalvation or damnation, as men are; whence Mahomet pretended to be ſent for the converſion of genii as well as men.

3. As to the ſcriptures, the Mahometans are taught by the Koran, that God, in divers ages of the world, gave revelations of his will in writing to ſeveral prophets, the whole and every one of which it is abſolutely neceſſary for a good Moſlem to believe. The number of theſe ſacred books were, according to them, 104. Of which 10 were given to Adam, 50 to Seth, 40 to Edris or Enoch, 10 to Abraham; and the other four, being the Pentateuch, the Pſalms, the Goſpel, and the Koran, were ſucceſſively delivered to Moſes, David, Jeſus, and Mahomet; which laſt being the ſeal of the prophets, thoſe revelations are now cloſed, and no more are to be expected. All theſe divine books, except the four laſt, they agree to be now entirely loſt, and their contents unknown; though the Sabians have ſeveral books which they attribute to ſome of the antediluvian prophets. And of thoſe four, the Pentateuch, Pſalms, and Goſpel, they ſay, have undergone ſo many alterations and corruptions, that, though there may poſſibly be ſome part of the true word of God therein, yet no credit is to be given to the preſent copies in the hands of the Jews and Chriſtians. The Mahometans have alſo a goſpel in Arabic, attributed to St Barnabas; wherein the hiſtory of Jeſus Chriſt is related in a manner very different from what we find in the true goſpels, and correſpondent to thoſe traditions which Mahomet has followed in his Koran. Of this goſpel the Moriſcoes in Africa have a tranſlation into Spaniſh; and there is, in the library of prince Eugene of Savoy, a manuſcript of ſome antiquity, containing an Italian tranſlation of the ſame goſpel; made, it is to be ſuppoſed, for the uſe of renegades. This book appears to be no original forgery of the Mahometans; though they have, no doubt, interpolated and altered it ſince, the better to ſerve their purpoſe; and in particular, inſtead of the *Paraclete*, or *Comforter*, they have in this aprocryphal goſpel inſerted the word *Periclyte*, that is, the "famous," or "illuſtrious;" by which they pretend their prophet was foretold by name, that being the ſignification of *Mohammed* in Arabic: and this they ſay to juſtify that paſſage of the Koran, where Jeſus Chriſt is formally aſſerted to have foretold his coming, under his other name of *Ahmed*, which is derived from the ſame root as *Mohammed*, and of the ſame import. From theſe, or ſome other forgeries of the ſame ſtamp, it is that the Mahometans quote ſeveral paſſages, of which there are not the leaſt footſteps in the New Teſtament.

4. The number of the prophets, which have been from time to time ſent by God into the world, amounts to no leſs than 224,000, according to one Mahometan tradition; or to 124,000, according to another: among whom 313 were apoſtles, ſent with ſpecial commiſſions to reclaim mankind from infidelity and ſuperſtition; and ſix of them brought new laws or diſpenſations, which ſucceſſively abrogated the preceding: theſe were Adam, Noah, Abraham, Moſes, Jeſus, and Mahomet. All the prophets in general, the Mahometans believe to have been free from great

ſins and errors of conſequence, and profeſſors of one and the ſame religion, that is, Iſlam notwithſtanding the different laws and inſtitutions which they obſerved They allow of degrees among them, and hold ſome of them to be more excellent and honourable than others. The firſt place they give to the revealers and eſtabliſhers of new diſpenſations, and the next to the apoſtles.

In this great number of prophets, they not only reckon divers patriarchs and perſons named in ſcripture, but not recorded to have been prophets (wherein the Jewiſh and Chriſtian writers have ſometimes led the way), as Adam, Seth, Lot, Iſhmael, Nun, Joſhua, &c. and introduce ſome of them under different names, as *Enoch*, *Heber*, and *Jethro*, who are called, in the Koran, *Edris*, *Hud*, and *Shoaib*; but ſeveral others whoſe very names do not appear in ſcripture (though they endeavour to find ſome perſons there to fix them on), as Saleh, Khedr, Dhu'lkefl, &c.

5. The belief of a general reſurrection and a future judgment.

When a corpſe is laid in the grave, they ſay he is received by an angel, who gives him notice of the coming of the two examiners; who are two black livid angels, of a terrible appearance, named *Monker* and *Nakir*. Theſe order the dead perſon to ſit upright; and examine him concerning his faith, as to the unity of God, and miſſion of Mahomet: if he anſwer rightly, they ſuffer the body to reſt in peace, and it is refreſhed by the air of paradiſe; but, if not, they beat him on the temples with iron maces, till he roars out for anguiſh ſo loud, that he is heard by all from eaſt to weſt, except men and genii. They then preſs the earth on the corpſe which is gnawed and ſtung till the reſurrection by 99 dragons, with ſeven heads each; or, as others ſay, their ſins will become venomous beaſts, the grievous ones ſtinging like dragons, the ſmaller like ſcorpions, and the other like ſerpents: circumſtances which ſome underſtand in a figurative ſenſe.

As to the ſoul, they hold, that, when it is ſeparated from the body by the angel of death, who performs his office with eaſe and gentleneſs towards the good, and with violence towards the wicked, it enters into that which they call *al berzakh*, or *the interval* between death and the reſurrection. If the departed perſon was a believer, they ſay two angels meet it, who convey it to heaven, that its place there may be aſſigned, according to its merit and degree. For they diſtinguiſh the ſouls of the faithful into three claſſes: the firſt of prophets, whoſe ſouls are admitted into paradiſe immediately; the ſecond of martyrs, whoſe ſpirits, according to a tradition of Mahomet, reſt in the crops of green birds, which eat of the fruits and drink of the rivers of paradiſe; and the third of other believers concerning the ſtate of whoſe ſouls before the reſurrection there are various opinions.

Though ſome among the Mahometans have thought that the reſurrection will be merely ſpiritual, and no more than the returning of the ſoul to the place whence it firſt came (an opinion defended by Ebn Sina, and called by ſome the *opinion of the philoſopher*); and others who allow man to conſiſt of body only, that it will be merely corporeal; the received opinion is, that both body and ſoul will be raiſed: and their doctors argue ſtrenuouſly for the poſſibility of the reſurrection of the body, and diſpute with great ſubtility concerning the manner of it. But Mahomet has taken care to preſerve one part of the body, whatever becomes of the reſt, to ſerve for a baſis of the future edifice, or rather a leaven for the maſs which is to be joined to it. For he taught that a man's body was entirely conſumed by the earth, except only the bone called *al ajb*, which we name the *os coccygis*, or rump-bone; and that, as it was the firſt formed in the human body, it will alſo remain uncorrupted to the laſt day, as a ſeed from whence the whole is to be renewed; and this he ſaid, would be affected by a forty years rain, which God ſhould ſend, and which would cover the earth to the height of 12 cubits, and cauſe the bodies to ſprout forth like plants. Herein, alſo, is Mahomet beholden to the Jews; who ſay the ſame things of the bone Luz, excepting that what he attributes to a great rain, will be affected according to them, by a dew, impregnating the duſt of the earth.

The time of the reſurrection the Mahometans allow to be a perfect ſecret to all but God alone; the angel Gabriel himſelf acknowledging his ignorance in this point, when Mahomet aſked him about it. However, they ſay, the approach of that day may be known from certain ſigns which are to precede it. Theſe ſigns they diſtinguiſh into two ſorts, the leſſer and the greater.

The leſſer ſigns are, 1. The decay of faith among men. 2. The advancing of the meaneſt perſons to eminent dignity. 3. That a maid-ſervant ſhall become the mother of her miſtreſs (or maſter); by which is meant, either that towards the end of the world men ſhall be much given to ſenſuality, or that the Mahometans ſhall then take many captives. 4. Tumults and ſeditions. 5. A war with the Turks. 6. Great diſtreſs in the world, ſo that a man, when he paſſes by another's grave, ſhall ſay, Would to God I were in his place. 7. That the provinces of Irac and Syria ſhall refuſe to pay their tribute. And, 8. That the buildings of Median ſhall reach to Ahab, or Yahab.

The greater ſigns are. 1. The ſun's riſing in the weſt; which ſome have imagined it originally did. 2. The appearance of the beaſt, which ſhall riſe out of the earth, in the temple of Mecca, or on mount Safa, or in the territory of Tayef, or ſome other place. This beaſt, they ſay is to be 60 cubits high; though others, not ſatisfied with ſo ſmall a ſize, will have her reach to the clouds and to heaven, when her head only is out: and that ſhe will appear for three days, but ſhow only a third part of her body. They deſcribe this monſter, as to her form, to be a compound of various ſpecies; having the head of a bull the eyes of a hog, the ears of an elephant, the horns of a ſtag, the neck of an oſtrich, the breaſt of a lion, the colour of a tiger, the back of a cat, the tail of a ram, the legs of the camel, and the voice of an aſs. Some ſay this beaſt is to apppear three times in ſeveral places, and that ſhe will bring with her the rod of Moſes and the ſeal of Solomon; and being ſo ſwift that none can overtake or eſcape her, will with the firſt ſtrike all the believers on the face, and mark them with the word *mumen*, *i. e.* believer; and with the latter will mark the unbelievers on the face likewiſe, with the word *Cafer, i. e.* infidel, that every perſon may be known for what he really is. They add, that the ſame beaſt is to demonſtrate the vanity of all religions except Iſlam, and to ſpeak the Arabic. All this ſtuff ſeems to be the reſult of a confuſed idea of the beaſt in the Revelations. 3. War with the Greeks and the taking Conſtantinople by 70,000 of the poſterity of Iſaac, who ſhall not win that city by force of arms, but the walls ſhall fall down while they cry out, *There is no God but God, God is moſt great!* As they are dividing the ſpoil, news will come to them of the appearance of Antichriſt; whereupon they ſhall leave all, and return back. 4. The coming of Antichriſt, whom the Mahometans call *Maſib al Dajjal, i. e.* the falſe or lying Chriſt, and ſimply *al Dajjal*. He is to be one-eyed, and marked on the forehead with the letters C. F. R. ſignifying *Cafer*, or infidel. They ſay that the Jews give him the name of *Meſſiah Ben David;* and pretend he is to come in the laſt days, and to be lord both of land and ſea, and that he will reſtore the kingdom to them. 5. The deſcent of Jeſus on earth. They pretend that he is to deſcend near the white tower to the eaſt of Damaſcus, when the people are returned from the taking of Conſtantinople: that he is to embrace the Mahometan religion, marry a wife, get children, kill Antichriſt; and at length die after 40 years, or, according to others, 24 years continuance on earth. Under him, they ſay, there will be great ſecurity and plenty in the world, all hatred and malice being laid aſide; when lions and camels, bears and ſheep, ſhall live in peace, and a child ſhall play with ſerpents unhurt. 6. War with the Jews; of whom the Mahometans are to make a prodigious ſlaughter, the very trees and ſtones diſcovering ſuch of them as hide themſelves, except only the tree called *gharkad*, which is the tree of the Jews. 7. The eruption of Gog and Magog, or, as they are called in the eaſt, *Yajug* and *Majuj*; of whom many things are related in the Koran and the traditions of Mahomet. Theſe barbarians, they tell us, having paſſed the lake of Tiberias, which the vanguard of their vaſt army will drink dry, will come to Jeruſalem, and there greatly diſtreſs Jeſus and his companions; till, at his requeſt, God will deſtroy them, and fill the earth with their carcaſes, which, after ſome time, God will ſend birds to carry away, at the prayers of Jeſus and his followers. Their bows, arrows, and quivers, the Moſlems will burn for ſeven years together; and at laſt, God will ſend a rain to cleanſe the earth and to make it fertile. 8. A ſmoke which ſhall fill the whole earth. 9. An eclipſe of the moon. Mahomet is reported to have ſaid, that there would be three eclipſes before the laſt hour; one to be ſeen in the eaſt, another in the weſt, and the third in Arabia. 10. The returning of the Arabs to the worſhip of Allat and al Uzza, and the reſt of their ancient idols, after the deceaſe of every one in whoſe heart there was faith equal to a grain of muſtard-ſeed, none but the very worſt of men being left alive. For God, they ſay, will ſend a cold odoriferous wind, blowing from Syria Damaſcena, which ſhall ſweep away the ſouls of all the faithful, and the Koran itſelf, ſo that men will remain in the groſſeſt ignorance for 100 years. 11. The diſcovery of a vaſt heap of gold and ſilver by the retreating of the Euphrates, which will be the deſtruction of many. 12. The demolition of the Caaba, or temple of Mecca, by the Ethiopians. 13. The ſpeaking of beaſts and inanimate things. 14. The breaking out of fire in the province of Hejaz; or, according to others, in Yaman. 15. The appearance of a man of the deſcendants of Kahtan, who ſhall drive men before him with his ſtaff. 16. The coming of the Mohdi, or director concerning whom Mahomet propheſied, that the world ſhould not have an end till one of his own family ſhould govern the Arabians, whoſe name ſhould be the ſame with his own name, and whoſe father's name ſhould alſo be the ſame with his father's name; and who ſhould fill the earth with righteouſneſs. This perſon the Shiites believe to be now alive, and concealed in ſome ſecret place till the time of his manifeſtation; for they ſuppoſe him no other than the laſt of the 12 Imams, named *Mahomet Abu'lakſem*, as their prophet was; and the ſon of Haſſan al Aſkeri, the 11th of that ſucceſſion. He was born at Sermanrai, in the 255th year of the Hegira. From this tradition, it is to be preſumed, an opinion pretty current among the Chriſtians took its riſe, that the Mahometans are in expectation of their prophet's return. 17. A wind which ſhall ſweep away the ſouls of all who have but a grain of faith in their hearts, as has been mentioned under the tenth ſign.

Theſe are the greater ſigns, which, according to their doctrine, are to precede the reſurrection, but ſtill leave the hour of it uncertain; for the immediate ſign of its being come will be the firſt blaſt of the trumpet, which they believe will be ſounded three times. The firſt they call the *blaſt of conſternation*; at the hearing of which all creatures in heaven and earth ſhall be ſtruck with terror, except thoſe whom God ſhall pleaſe to exempt from it. The effects attributed to this firſt ſound of the trumpet are very wonderful: for they ſay the earth will be ſhaken, and not only all buildings, but the very mountains levelled; that the heavens ſhall melt, the ſun be darkened, the ſtars fall, on the death of the angels, who, as ſome imagine, hold them ſuſpended between heaven and earth; and the ſea ſhall be troubled and dried up, or, according to others, turned into flames, the ſun, moon, and ſtars being thrown into it the Koran, to expreſs the greatneſs of the terror of that day, adds, that women who give ſuck ſhall abandon the care of their infants, and even the ſhe camels which have gone 10 months with young (a moſt valuable part of the ſubſtance of that nation) ſhall be utterly neglected. A farther effect of this blaſt will be that concourſe of beaſts mentioned in the Koran, though ſome doubt whether it be to precede the reſurrection or not. They who ſuppoſe it will precede, think that all kinds of animals, forgetting their reſpective natural fierceneſs and timidity, will run together into one place, being terrified by the ſound of the trumpet and the ſudden ſhock of nature.

The Mahometans believe that this firſt blaſt will be followed by a ſecond, which they call the *blaſt of exinanition;* by which all creatures both in heaven and earth ſhall die or be annihilated, except thoſe which God ſhall pleaſe to exempt from the common fate; and this they ſay, ſhall happen in the twinkling of an eye, nay in an inſtant; nothing ſurviving except God alone, with paradiſe and hell, and the inhabitants of thoſe two places, and the throne of glory. The laſt who ſhall die will be the angel of death.

Forty years after this will be heard the *blaſt of reſurrection*, when the trumpet ſhould be ſounded the third time by Iſraſil, who, together with Gabriel and Michael, will be previouſly reſtored to life, and, ſtanding on the rock of the temple of Jeruſalem, ſhall, at God's command, call together all the dry and rotten bones, and other diſperſed parts of the bodies, and the very hairs to judgment. This angel, having by the divine order, ſet the trumpet to his mouth, and called together all the ſouls from all parts, will throw them into his trumpet, from whence, on his giving the laſt ſound at the command of God, they will fly forth like bees, and fill the whole ſpace between heaven and earth, and then repair to their reſpective bodies, which the opening earth will ſuffer to ariſe; and the firſt who ſhall ſo ariſe, according to a tradition of Mahomet, will be himſelf. For this birth the earth will be prepared by the rain above-mentioned, which is to fall continually for 40 years, and will reſemble the ſeed of a man, and be ſupplied from the water under the throne of God, which is called *living water*; by the efficacy and virtue of which the dead bodies ſhall ſpring forth from their graves, as they did in their mother's womb, or as corn ſprouts forth by common rain, till they become perfect; after which breath will be breathed into them, and they will ſleep in their ſepulchres till they are raiſed to life at the laſt trump.

When thoſe who have riſen ſhall have waited the limited time the Mahometans believe God will at length appear to judge them; Mahomet undertaking the office of interceſſor, after it ſhall have been declined by Adam, Noah, Abraham, and Jeſus, who ſhall beg deliverance only for their own ſouls. They ſay, that on this ſolemn occaſion God will come in the clouds ſurrounded by angels, and will produce the books wherein the actions of every perſon are recorded by their guardian angels, and will command the prophets to bear witneſs againſt thoſe to whom they have been reſpectively ſent. Then every one will be examined concerning all his words and actions uttered and done by him in this life; not as if God needed any information in theſe reſpects, but to oblige the perſon to make public confeſſion and acknowledgement of God's juſtice. The particulars of which they ſhall give an account, as Mahomet himſelf enumerated them, are, of their time, how they ſpent it; of their wealth, by what means they acquired it, and how they employed it; of their bodies, wherein they exerciſed them; of their knowledge and learning, what uſe they made of them. To the queſtions we have mentioned each perſon ſhall anſwer, and make his defence in the beſt manner he can, endeavouring to excuſe himſelf by caſting the blame of his evil deeds on others; ſo that a diſpute ſhall ariſe even between the ſoul and the body, to which of them their guilt ought to be imputed: the ſoul ſaying, *O Lord, my body I received from thee; for thou createdſt me without a hand to lay hold with, a foot to walk with, an eye to ſee with, or an underſtanding to apprehend with, till I came and entered into this body; therefore puniſh it eternally but deliver me.* The body, on the other ſide will make this apology: *O Lord, thou createdſt me like a ſtock of wood, having neither hand that I could lay hold with, nor foot that I could walk with, till this ſoul, like a ray of light, entered into me, and my tongue began to ſpeak, my eye to ſee, and my foot to walk; therefore puniſh it eternally; but deliver me.* But God will propound to them the following parable of the blind man and the lame man, which, as well as the preceding diſpute, was borrowed by the Mahometans from the Jews. A certain king, having a pleaſant garden, in which were ripe fruits, ſet two perſons to keep it, one of whom was blind, and the other lame; the former not being able to ſee the fruit, nor the latter to gather it: the lame man, however, ſeeing the fruit, perſuaded the blind man to take him upon his ſhoulders, and by that means he eaſily gathered the fruit; which they divided between them. The lord of the garden coming ſome time after, and enquiring after his fruit, each began to excuſe himſelf; the blind man ſaid he had no eyes to ſee with; and the lame man, that he had no feet to approach the trees. But the king, ordering the lame man to be ſet on the blind, paſſed ſentence on and puniſhed them both. And in the ſame manner will God deal with the body and the ſoul. As theſe apologies will not avail on that day, ſo it will be in vain for any one to deny his evil actions; ſince men and angels, and his own members, nay, the very earth itſelf, will be ready to bear witneſs againſt him.

At this examination, they alſo believe, that each perſon will have the book wherein all the actions of his life are written delivered to him: which books the righteous will receive into their right hand, and read with great pleaſure and ſatisfaction; but the ungodly will be obliged to take them, againſt their wills, in their left, which will be bound behind their backs, their right hand being tied up to their necks.

To ſhow the exact juſtice which will be obſerved on this great day of trial, the next thing they deſcribe is the balance wherein all things ſhall be weighed. They ſay it will be held by Gabriel; and that it is of ſo vaſt a ſize, that its two ſcales, one of which hangs over paradiſe, and the other over hell, are capacious enough to contain both heaven and hell. Though ſome are willing to underſtand what is ſaid in the Koran concerning this balance allegorically, and only as a figurative repreſentation of God's equity; yet the more ancient and orthodox opinion is, that they are to be taken literally; and ſince words and actions, being mere accidents, are not capable of being themſeves weighed, they ſay that the books wherein they are written will be thrown into the ſcales, and according as thoſe wherein the good and evil actions are recorded ſhall preponderate, ſentence will be given: thoſe whoſe balances laden with good works ſhall be heavy will be ſaved; but thoſe whoſe balances are light, will be condemned. Nor will any one have cauſe to complain that God ſuffers any good action to paſs unrewarded, becauſe the wicked for the good they do have their reward in this life, and therefore can expect no favour in the next.

This examination being paſt, and every one's works weighed in a juſt balance, that mutual retaliation will follow, according to which every creature will take vengeance one of another, or have ſatisfaction made them for the injuries which they have ſuffered. And, ſince there will be then no other way of returning like for

like,

like, the manner of giving this ſatisfaction will be by taking away a proportional part of the good works of him who offered the injury, and adding it to thoſe of him who ſuffered it. Which being done, if the angels (by whoſe miniſtry this is to be performed) ſay, *Lord, we have given to every one his due, and there remaineth of this perſon's good works ſo much as equalleth the weight of an ant,* God will, of his mercy, cauſe it to be doubled unto him, that he may be admitted into paradiſe; but if, on the contrary, his good works be exhauſted, and there remain evil works only, and there be any who have not yet received ſatisfaction from him, God will order that an equal weight of their ſins be added unto his, that he may may be puniſhed for them in their ſtead, and will be ſent to hell laden with both. This will be the method of God's dealing with mankind. As to brutes, after they ſhall have likewiſe taken vengeance of one another, he will command them to be changed into duſt; wicked men being reſerved to more grievous puniſhment, ſo that they ſhall cry out on hearing this ſentence paſſed on the brutes, *Would to* GOD *that we were duſt alſo.* As to the genii, many Mahometans are of opinion, that ſuch of them as are true believers, will undergo the ſame fate as the irrational animals, and have no other reward than the favour of being converted into duſt; and for this they quote the authority of their prophet.

The trials being over, and the aſſembly diſſolved, the Mahometans hold, that thoſe who are to be admitted into paradiſe will take the right hand way, and thoſe who are deſtined to hell-fire will take the left; but both of them muſt firſt paſs the bridge called in Arabic *al Sirat,* which they ſay is laid over the midſt of hell, and deſcribe to be finer than a hair, and ſharper than the edge of a ſword; ſo that it ſeems very difficult to conceive how any one ſhall be able to ſtand upon it: for which reaſon moſt of the ſect of the Motazalites reject it as a fable; though the orthodox think it a ſufficient proof of the truth of this article, that it was ſeriouſly affirmed by him who never aſſerted a falſehood, meaning their prophet: who, to add to the difficulty of the paſſage, has likewiſe declared; that this bridge is beſet on each ſide with briars and hooked thorns: which will however be no impediment to the good; for they ſhall paſs with wonderful eaſe and ſwiftneſs, like lightning, or the wind, Mahomet and his Moſlems leading the way; whereas the wicked, what with the ſlipperineſs and extreme narrowneſs of the path, the entangling of the thorns, and the extinction of the light which directed the former to paradiſe, will ſoon miſs their footing, and fall down headlong into hell, which is gaping beneath them.

As to the puniſhment of the wicked, the Mahometans are taught, that hell is divided into ſeven ſtories or apartments, one below another, deſigned for the reception of as many diſtinct claſſes of the damned. The firſt, which they call *Jehannam,* they ſay, will be the receptacle of thoſe who acknowledged one God, that is, the wicked Mahometans; who after having there been puniſhed according to their demerits, will at length be releaſed. The ſecond, named *Ladha,* they aſſign to the Jews; the third, named *al Hotama,* to the Chriſtians; the fourth, named *al Sair* to the Sabians; the fifth, named *Sakir,* to the Magians; the ſixth named *al Jahim,* to the idolaters, and the ſeventh, which is the loweſt and worſt of all, and is called *al Hawyat,* to the hypocrites, or thoſe who outwardly profeſſed ſome religion, but in their hearts were of none. Over each of theſe departments they believe there will be ſet a guard of angels, 19 in number; to whom the damned will confeſs the juſt judgment of God, and beg them to intercede with him for ſome alleviation of their pain, or that they may be delivered by being annihilated.

Mahomet has, in his Koran and traditions, been very exact in deſcribing the various torments of hell, which, according to him, the wicked will ſuffer both from intenſe heat and exceſſive cold. We ſhall however, enter into no detail of them here; but only obſerve, that the degrees of theſe pains will alſo vary in proportion to the crimes of the ſufferer, and the apartment he is condemned to; and that he who is puniſhed the moſt lightly of all will be ſhod with ſhoes of fire the fervour of which will cauſe his ſkull to boil like a cauldron. The condition of theſe unhappy wretches, as the ſame prophet teaches, cannot be properly called either *life* or *death*; and their miſery will be greatly increaſed by their deſpair of being ever delivered from that place, ſince, according to that frequent expreſſion in the Koran, *they muſt remain therein for ever.* It muſt be remarked, however, that the infidels alone will be liable to eternity of damnation; for the Moſlems, or thoſe who have embraced the true religion, and have been guilty of heinous ſins will be delivered thence after they ſhall have expiated their crime by their ſufferings. The time which theſe believers ſhall be detained there, according to a tradition handed down from their prophet, will be no leſs than 900 years, nor more than 7000. And, as to the manner of their delivery, they ſay that they ſhall be diſtinguiſhed by the marks of proſtration on thoſe parts of their bodies with which they uſed to touch the ground in prayer, and over which the fire will therefore have no power; and that, being known by this characteriſtic, they will be releaſed by the mercy of God, at the interceſſion of Mahomet and the bleſſed: whereupon thoſe who ſhall have been dead will be reſtored to life, as has been ſaid; and thoſe whoſe bodies ſhall have contracted any ſootineſs or filth from the flames and ſmoke of hell, will be immerſed in one of the rivers of paradiſe, called the *river of life,* which will waſh them whiter than pearls.

The righteous, as the Mahometans are taught to believe, having ſurmounted the difficulties, and paſſed the ſharp bridge abovementioned, before they enter paradiſe, will be refreſhed by drinking at the *pond* of their prophet, who deſcribes it to be an exact ſquare of a month's journey in compaſs; its water which is ſupplied by two pipes from al Cawthar, one of the rivers of paradiſe, being whiter than milk or ſilver, and more odoriferous than muſk, with as many cups ſet around it as there are ſtars in the firmament; of which water whoever drinks will thirſt no more for ever. This is the firſt taſte which the bleſſed will have of their future and now near-approaching felicity.

Though paradiſe be ſo very frequently mentioned in the Koran, yet it is a diſpute among the Mahometans whether it be already created, or to be created hereafter; the Motazalites and ſome other

Mahometaniſm.

ſectaries aſſerting, that there is not at preſent any ſuch place in nature, and that the paradiſe which the righteous will inhabit in the next life will be different from that from which Adam was expelled. However, the orthodox profeſs the contrary, maintaining that it was created even before the world, and deſcribe it from their prophet's traditions, in the following manner.

They ſay it is ſituated above the ſeven heavens (or in the ſeventh heaven), and next under the throne of God; and, to expreſs the amenity of the place, tell us, that the earth of it is of the fineſt wheat-flour, or of the pureſt muſk, or, as others will have it, of ſaffron: that its ſtones are pearls and jacinths, the walls of its buildings enriched with gold and ſilver, and that the trunks of all its trees are of gold: among which the moſt remarkable is the tree called *Tuba*, or the tree of happineſs. Concerning this tree, they fable, that it ſtands in the palace of Mahomet, though a branch of it will reach to the houſe of every true believer; that it will be laden with pomegranates, grapes, dates, and other fruit, of ſurpriſing bigneſs, and of taſtes unknown to mortals. So that if a man deſire to eat of any particular kind of fruit, it will immediately be preſented him; or, if he chooſe fleſh, birds ready dreſſed will be ſet before him, according to his wiſh. They add, that the boughs of this tree will ſpontaneouſly bend down to the hand of the perſon who would gather of its fruits, and that it will ſupply the bleſſed not only with food, but alſo with ſilken garments, and beaſts to ride on ready ſaddled and bridled, and adorned with rich trappings, which will burſt forth from its fruits; and that this tree is ſo large, that a perſon, mounted on the fleeteſt horſe, would not be able to gallop from one end of its ſhade to the other in 100 years.

As plenty of water is one of the greateſt additions to the pleaſantneſs of any place, the Koran often ſpeaks of the rivers of paradiſe as a principal ornament thereof; ſome of theſe rivers, they ſay, flow with water, ſome with milk, ſome with wine, and others with honey; all taking their riſe from the root of the tree Tuba.

But all theſe glories will be eclipſed by the reſplendent and raviſhing girls of paradiſe, called from their large black eyes, *Hur al oyun*, the enjoyment of whoſe company will be a principal felicity of the faithful. Theſe, they ſay, are created, not of clay, as mortal women are, but of pure muſk; being, as their prophet often affirms in his Koran, free from all natural impurities, defects and inconveniences incident to the ſex, of the ſtricteſt modeſty, and ſecluded from public view in pavilions of hollow pearls, ſo large that as ſome traditions have it, one of them will be no leſs than four paraſangs (or, as others ſay, 60 miles) long, and as many broad.

The name which the Mahometans uſually give to this happy manſion, is *al Jannat*, or "the garden;" and ſometimes they call it, with an addition, *Jannat al Ferdaws*, "the garden of paradiſe;" *Jannat Eden*, "the garden of Eden," (though they generaly interpret the word *Eden*, not according to its acceptation in Hebrew, but according to its meaning in their own tongue, wherein it ſignifies "a ſettled or perpetual habitation;") *Jannat al Mawa*, "the garden of abode;" *Jannat al Naim*, "the garden of pleaſure; and the like: by which ſeveral appellations ſome underſtand ſo many different gardens, or at leaſt places of different degrees of felicity (for they reckon no leſs than 100 ſuch in all), the very meaneſt whereof will afford its inhabitants ſo many pleaſures and delights, that one would conclude they muſt even ſink under them, had not Mahomet declared, that, in order to qualify the bleſſed for a full enjoyment of them, God will give to every one the abilities of 100 men.

6. God's abſolute decree and predeſtination both of good and evil. The orthodox doctrine is, that whatever hath or ſhall come to paſs in this world, whether it be good, or whether it be bad, proceedeth entirely from the divine will, and is irrevocably fixed and recorded from all eternity in the preſerved table: God having ſecretly predetermined not only the adverſe and proſperous fortune of every perſon in this world, in the moſt minute particulars, but alſo his faith or infidelity, his obedience or diſobedience, and conſequently his everlaſting happineſs or miſery after death; which fate or predeſtination it is not poſſible by any foreſight or wiſdom to avoid.

Of this doctrine Mahomet makes great uſe in his Koran for the advancement of his deſigns; encouraging his followers to fight without fear, and even deſperately, for the propagation of their faith, by repreſenting to them, that all their caution could not avert their inevitable deſtiny, or prolong their lives for a moment; and deterring them from diſobeying or rejecting him as an impoſtor, by ſetting before them the danger they might thereby incur of being, by the juſt judgment of God, abandoned to ſeduction, hardneſs of heart, and a reprobate mind, as a puniſhment for their obſtinacy.

II. *Religious practice.* 1. The firſt point is *prayer*, under which are alſo comprehended thoſe legal waſhings or purifications which are neceſſary preparations thereto.

Of theſe purifications there are two degrees, one called *ghoſt*, being a total immerſion or bathing of the body in water; and the other called *wodu* (by the Perſians, *abdeſt*), which is the waſhing of their faces, hands, and feet, after a certain manner. The firſt is required in ſome extraordinary caſes only, as after having lain with a woman, or being polluted by emiſſion of ſeed, or by approaching a dead body; women alſo being obliged to it after their courſes or childbirth. The latter is the ordinary ablution in common caſes, and before prayer, and muſt neceſſarily be uſed by every perſon before he can enter upon that duty. It is performed with certain formal ceremonies, which have been deſcribed by ſome writers, but much eaſier apprehended by ſeeing them done, than by the beſt deſcription.

That his followers might be more punctual in this duty, Mahomet is ſaid to have declared, that *the practice of religion is founded on cleanlineſs*, which is the *one half of the faith*, and the *key of prayer*, without which it will not be heard by God. That theſe expreſſions may be the better underſtood, al Ghazali reckons four degrees of purification; of which the firſt is the cleanſing of the body from all pollution, filth, and excrements; the ſecond, the cleanſing of the members of the

the body from all wickedneſs and unjuſt actions; the third, the cleanſing the heart from all blameable inclinations and odious vices; and the fourth, the purging a man's ſecret thoughts from all affections which may divert their attendance on God; adding, that the body is but as the outward ſhell, in reſpect to the heart, which is the kernel.

Circumciſion, though it be not ſo much as once mentioned in the Koran, is yet held by the Mahometans to be an ancient divine inſtitution, confirmed by the religion of Iſlam, and though not ſo abſulutely neceſſary but that it may be diſpenſed with in ſome caſes, yet highly proper and expedient. The Arabs uſed this rite for many ages before Mahomet, having probably learned it from Iſhmael, though not only his deſcendants, but the Hamyarites and other tribes practiſed the ſame. The Iſhmaelites, we are told, uſed to circumciſe their children, not on the eighth day, as is the cuſtom of the Jews, but when about 12 or 13 years old, at which age their father underwent that operation; and the Mahometans imitate them ſo far as not to circumciſe children before they may be able at leaſt diſtinctly to pronounce that profeſſion of their faith, *There is no* God *but* God, Mahomet *is the apoſtle of* God; but pitch on what age they pleaſe for the purpoſe, between 6 and 16, or thereabouts.

Prayer was by Mahomet thought ſo neceſſary a duty, that he uſed to call it *the pillar of religion,* and *the key of paradiſe:* and when the Thakifites, who dwelt at Tayef, ſending in the ninth year of the Hegira, to make their ſubmiſſion to the prophet, after the keeping of their favourite idol had been denied them, begged at leaſt, that they might be diſpenſed with as to their ſaying of their appointed prayers, he anſwered, *That there could be no good in that religion wherein was no prayer.*

That ſo important a duty, therefore, might not be neglected, Mahomet obliged his followers to pray five times every 24 hours, at certain ſtated times; viz. 1. In the morning before ſunriſe: 2. When noon is paſt, and the ſun begins to decline from the meridian: 3. In the afternoon before ſun-ſet: 4. In the evening, after ſun-ſet: and before day be ſhut in: and, 5. After the day is ſhut in and before the firſt watch of the night. For this inſtitution he pretended to have received the divine command from the throne of God himſelf, when he took his night-journey to heaven; and the obſerving of the ſtated times of prayer is frequently inſiſted on in the Koran, though they be not particularly preſcribed therein. Accordingly, at the aforeſaid times, of which public notice is given by the Muedhdhins, or Criers, from the ſteeples of their moſques (for they uſe no bells), every conſcientious Moſlem prepares himſelf for prayer, which he performs either in the moſque or any other places provided it be clean, after a preſcribed form, and with a certain number of praiſes or ejaculations (which the more ſcrupulous count by a ſtring of beads), and uſing certain poſtures of worſhip; all which have been particularly ſet down and deſcribed, though with ſome few miſtakes, by other writers, and ought not to be abriged, unleſs in ſome ſpecial caſes, as on a journey, on preparing for battle, &c.

For the regular performance of the duty of prayer among the Mahometans, beſides the particulars abovementioned, it is alſo requiſite that they turn their faces, while they pray, towards the temple of Mecca; the quarter where the ſame is ſituated, being, for that reaſon, pointed out within their moſques by a nich, which they call *al Mehrab;* and without by the ſituation of the doors opening into the galleries of the ſteeples: there are alſo tables calculated for the ready finding out their Keblah, or part towards which they ought to pray, in places where they have no other direction.

2. *Alms* are of two ſorts, *legal* and *voluntary.* The *legal alms* are of indiſpenſable obligation, being commanded by the law, which directs and determines both the portion which is to be given, and of what things it ought to be given; but the *voluntary alms* are left to every one's liberty, to give more or leſs, as he ſhall ſee fit. The former kind of alms ſome think to be properly called *zacat,* and the latter *ſadakat;* though this name be alſo frequently given to the legal alms. They are called *zacat,* either becauſe they *increaſe* a man's ſtore by drawing down a bleſſing thereon, and produce in his ſoul the virtue of liberality; or becauſe they *purify* the remaining part of one's ſubſtance from pollution, and the ſoul from the filth of avarice; and *ſadakat,* becauſe they are a proof of a man's ſincerity in the worſhip of God. Some writers have called the legal alms *tithes;* but improperly, ſince in ſome caſes they fall ſhort, and in others exceed that proportion.

3. *Faſting* is a duty of ſo great moment, that Mahomet uſed to ſay it was *the gate of religion,* and that the *odour of the mouth of him who faſteth is more grateful to* God *than that of muſk;* and al Ghazali reckons faſting *one fourth part of the faith.* According to the Mahometan divines, there are three degrees of faſting: 1. The reſtraining the belly and other parts of the body from ſatisfying their luſts: 2. The reſtraining the ears, eyes, tongue, hands, feet, and other members, from ſin; and, 3. The faſting of the heart from worldly cares, and reſtraining the thought from every thing beſides God.

The Mahometans are obliged by the expreſs command of the Koran, to faſt the whole month of Ramadan, from the time the new moon firſt appears, till the appearance of the next new moon; during which time they muſt abſtain from eating, drinking, and women, from day-break till night or ſun-ſet. And this injunction they obſerve ſo ſtrictly, that, while they faſt, they ſuffer nothing to enter their mouths, or other parts of their body, eſteeming the faſt broken and null, if they ſmell perfumes, take a clyſter or injection, bathe, or even purpoſely ſwallow their ſpittle; ſome being ſo cautious, that they will not open their mouths to ſpeak, leſt they ſhould breathe the air too freely: the faſt is alſo deemed void, if a man kiſs or touch a woman, or if he vomit deſignedly. But after ſunſet they are allowed to refreſh themſelves, and to eat and drink, and enjoy the company of their wives till day-break; though the more rigid begin the faſt again at midnight. This faſt is extremely rigorous and mortifying when the month of Ramadan happens to fall in ſummer (for the Arabian year being lunar, each month runs through all the different ſeaſons in the courſe of 33 years), the length and heat of the days making the obſervance of it much more difficult and uneaſy than in winter.

The reaſon given why the month of Ramadan was pitched on for this purpoſe is, that on that month the Koran was ſent down from heaven. Some pretend, that Abraham, Moſes, and Jeſus, received their reſpective revelations in the ſame month.

4. The pilgrimage to Mecca is ſo neceſſary a point of practice, that, according to a tradition of Mahomet, he who dies without performing it may as well die a Jew or a Chriſtian; and the ſame is expreſsly commanded in the Koran.

The temple of Mecca ſtands in the midſt of the city, and is honoured with the title of *Maſjad al elharam*, i. e. *the ſacred or inviolable temple*. What is principally reverenced in this place, and gives ſanctity to the whole, is a ſquare ſtone building, called the CAABA; (ſee that article).

To this temple every Mahometan, who has health and means ſufficient, ought, once at leaſt in his life, to go on pilgrimage; nor are women excuſed from the performance of this duty. The pilgrims meet at different places near Mecca, according to the different parts from whence they come, during the months of Shawal and Dhu'lkaada; being obliged to be there by the beginning of Dhu'lhajja; which month, as its name imports, is peculiarly ſet apart for the celebration of this ſolemnity.

At the place abovementioned the pilgrims properly commence ſuch; when the men put on the Ihram or ſacred habit, which conſiſts only of two woollen wrappers, one wrapped about their middle to cover their privities, and the other thrown over their ſhoulders, having their heads bare, and a kind of ſlippers which cover neither the heel nor the inſtep, and ſo enter the ſacred territory in their way to Mecca. While they have this habit on, they muſt neither hunt nor fowl, (though they are allowed to fiſh); which precept is ſo punctually obſerved, that they will not kill even a louſe or flea if they find them on their bodies: there are ſome noxious animals, however, which they have permiſſion to kill during the pilgrimage, as kites, ravens, ſcorpions, mice, and dogs given to bite. During the pilgrimage, it behoves a man to have a conſtant guard over his words and actions; to avoid all quarrelling or ill-language, all converſe with women, and all obſcene diſcourſe; and to apply his whole attention to the good work he is engaged in.

The pilgrims, being arrived at Mecca, immediately viſit the temple; and then enter on the performances of the perſcribed ceremonies, which conſiſt chiefly in going in proceſſion round the Caaba, in running between the mounts Safa and Merwa, in making the ſtation on mount Arafat, and ſlaying the victims, and ſhaving their heads in the valley of Mina.

In compaſſing the Caaba, which they do ſeven times, beginning at the corner where the black ſtone is fixed, they uſe a ſhort quick pace, the three firſt times they go round it, and a grave ordinary pace the four laſt; which, it is ſaid, was ordered by Mahomet, that his followers might ſhow themſelves ſtrong and active to cut off the hopes of the infidels, who gave out that the immoderate heats of Medina had rendered them weak. But the aforeſaid quick pace they are not obliged to uſe every time they perform this piece of devotion, but only at ſome particular times. So often as they paſs by the black ſtone, they either kiſs it, or touch it with their hand and kiſs that.

The running between Safa and Merwa is alſo performed ſeven times, partly with a ſlow pace and partly running: for they walk gravely till they come to a place between two pillars; and there they run, and afterwards walk again; ſometimes looking back, and ſometimes ſtopping, like one who had loſt ſomething, to repreſent Hagar ſeeking water for her ſon; for the ceremony is ſaid to be as ancient as her time.

On the ninth of Dhu'lhajja, after morning-prayer, the pilgrims leave the valley of Mina, whither they come the day before; and proceed in a tumultuous and ruſhing manner, to mount Arafat, where they ſtay to perform their devotions till ſun-ſet: then they go to Mozdalifa, an oratory between Arafat and Mina; and there ſpend the night in prayer and reading the Koran. The next morning by day break they viſit *al-Maſher al Karam*, or "the ſacred monument;" and, departing thence before ſun-riſe, haſte by Batn Mohaſſer to the valley of Mina, where they throw ſeven ſtones at three marks or pillars, in imitation of Abraham, who, meeting the devil in that place, and being by him diſturbed in his devotion, or tempted to diſobedience when he was going to ſacrifice his ſon, was commanded by God to drive him away by throwing ſtones at him; though others pretend this rite to be as old as Adam, who alſo put the devil to flight in the ſame place, and by the ſame means.

This ceremony being over, on the ſame day, the tenth of Dhu'lhajja, the pilgrims ſlay their victims in the ſaid valley of Mina; of which they and their friends eat part, and the reſt is given to the poor. Theſe victims muſt be either ſheep, goats, kine, or camels; males, if of either of the two former kinds; and females if of either of the latter; and of a fit age. The ſacrifices being over, they ſhave their heads and cut their nails, burying them in the ſame place; after which the pilgrimage is looked on as completed: though they again viſit the Caaba, to take their leave of that ſacred building.

The rapid ſucceſs which attended the propagation of this new religion was owing to cauſes that are plain and evident, and muſt remove, or rather prevent, our ſurprize, when they are attentively conſidered. The terror of Mahomet's arms, and the repeated victories which were gained by him and his ſucceſſors, were no doubt, the irreſiſtible arguments that perſuaded ſuch multitudes to embrace his religion and ſubmit to his dominion. Beſides, his law was artfully and marvellouſly adapted to the corrupt nature of man; and, in a more particular manner, to the manners and opinions of the eaſtern nations, and the vices to which they were naturally addicted: for the articles of faith which it propoſed were few in number, and extremely ſimple; and the duties it required were neither many nor difficult, nor ſuch as were incompatible with the empire of appetites and paſſions. It is to be obſerved farther, that the groſs ignorance, under which the Arabians, Syrians, Perſians, and the greateſt part of the eaſtern nations, laboured at this time, rendered many an eaſy prey to the artifice and eloquence of this bold adventurer. To theſe cauſes of the progreſs of Mahometiſm, we may add the bitter diſſenſions and cruel animoſities that reigned among the Chriſtian ſects, particularly the Greeks, Neſtorians, Eutychians, and Monophyſites; diſſenſions that filled a great part of the Eaſt with carnage, aſſaſſinations, and ſuch deteſtable enormities, as rendered the very name of Chriſtianity odious to many. We might add here, that the Monophyſites and Neſtorians, full of reſentment againſt the Greeks, from whom they had ſuffered the bittereſt and moſt injurious treatment, aſſiſted the Arabians in the conqueſt of ſeveral provinces, into which, of conſequence, the religion of Mahomet was afterwards introduced. Other cauſes of the ſudden progreſs of that religion will naturally occur to ſuch as conſider attentively its ſpirit and genius, and the ſtate of the world at this time.

MAHOMETANS, thoſe who believe in the religion and divine miſſion of Mahomet. See MAHOMET, MAHOMETANISM, and ALCORAN.

MAHRATTA. See MARHATTA.

MAHWAH, or MAWEE, in botany; an Eaſt Indian tree, ſo called by the natives of Bahar and the neighbouring countries, but of which the Shanſcrit name is *Madhuca* or *Madhudruma*. According to Lieut. C. Hamilton, by whom a very particular account of this tree is given in the *Aſiatic Reſearches* ‡, it is of the claſs of the polyandria-monogynia of Linnæus, but of a genus not deſcribed by him. The calyx is monophyllous, quadrifid, half divided, and imbricated in its divided part; the two oppoſite and outer parts covering partially the two oppoſite and inner. The corolla is monopetalous, having an inflated tube for its lower part, of near an inch long, thick, fleſhy, and of a cream colour: from this ariſe nine ſmall leaves, as it were, like petals from a calyx, that are imbricated and twiſted, one over the other, from right to left, claſping the lower part of the ſtyle in a point; by which they ſeem to ſerve, in ſome reſpect, like a forceps, to detach the whole corolla at the ſeaſon of its dropping. There are no filaments; but the antheræ, which and in number moſt commonly twenty-ſix, long, ſcabrous, and ſpear-headed, are inſerted in rows, on the inſide and upper part of the tube of the corolla. The ſtyle is long, round, and tapering, and projects about an inch beyond the corolla; it is ſucceeded by a drupe with a thick pericarpium, bilocular, containing two ſeeds or kernels covered with a dark brown ſkin: there are often, however, three of theſe, in three ſeparate diviſions. The flowers riſe in bunches, from the extremities of the ſmaller branches; and have each a pedicle of about an inch and a half long: theſe are moſtly turned downwards, whence the corollas more eaſily drop off.

The tree, when full grown, is about the ſize of a common Mango tree, with a buſhy head and oval leaves a little pointed; its roots ſpreading horizontally, are ſunk but little in the earth: the trunk, which is often of a conſiderable thickneſs, riſes ſeldom to any great height, without giving off branches; it is, however, not uncommon to ſee it ſhoot up clear to the length of eight or ten feet; the wood itſelf is moderately hard, fine grained, and of a reddiſh colour. By inciſion the tree affords a reſinous gum from the bark.

The flowers are of a nature very extraordinary "differing eſſentially (ſays Mr Hamilton) from thoſe of any other plant with which I am acquainted, as they have not, in any reſpect, the uſual appearance of ſuch, but rather reſemble *berries*; and I, like many others, had long conceived them to be the fruit of the Mahwah." The tree drops its leaves in the month of February, and early in March theſe flowers begin to come out in cluſters of thirty, forty, or fifty, from the extremity of every ſmall branch; and, from this period till the latter end of April, as the flowers come to maturity (for they never open or expand), they continue falling off, with their antheræ, in the mornings, a little after ſun-riſe; when they are gathered; and afterwards dried by an expoſure of a few days in the ſun: when thus prepared, they very much reſemble a dried grape, both in taſte and flavour. Immediately after the flowers drop off, freſh ſhoots are made for the new leaves, which ſoon make their appearance, coming preſently to their full growth.

The fruit (*properly* ſo called) is of two ſorts in ſhape; the one reſembling a ſmall walnut, the other ſomewhat larger and pointed: it is ripe towards the middle of May; and continues dropping from the tree till the whole fall, which is generally about the beginning or towards the middle of June. The outer covering, or *pericarpium*, which is of a ſoft texture, commonly burſts in the fall, ſo that the ſeeds are very eaſily ſqueezed out of it: the ſeeds are ſomewhat of the ſhape but longer than an olive. Theſe ſeeds are replete with a thick oil, of the conſiſtence of butter or *ghee*, which is obtained by expreſſion.

From this deſcription it may eaſily be conceived, that the Mahwah tree and its productions are of ſingular and general uſe, eſpecially in thoſe dry and barren countries, which, from the nature of their ſituation, are not ſo well calculated for producing in plenty or perfection the other neceſſaries of life.

The corolla or flowers, after being dried as before deſcribed, are eaten by the natives raw or dreſſed with their *curries*; and, when even ſimply boiled with rice, they afford a ſtrengthening and wholeſome nouriſhment. They are indeed, our author tells us, often applied to a leſs laudable purpoſe; for being fermented, they yield by diſtillation a ſtrong ſpirit, which the people here ſell ſo very cheap, that for one *pice* (about a half-penny) may be purchaſed no leſs than a *cutchaſeer* (above a pint Engliſh) with which any man may get completely drunk. Theſe flowers make an article of trade; being exported from this country to Patna and elſewhere in no inconſiderable quantities.

The oil yielded by the fruit, as before mentioned, reſembles ghee ſo much, that, being cheaper, the natives often mix it with that commodity. They uſe it the ſame as ghee in their victuals, and in the compoſition of ſome ſorts of ſweetmeats; and burn it in their lamps. It is alſo regarded as a ſalutary remedy, applied exteriorly to wounds and all cutaneous eruptions. It is at firſt of the conſiſtence of common oil, but ſoon coagulates: after being kept for ſome time, it acquires a bitteriſh taſte and rancid ſmell, which renders it ſomewhat leſs agreeable as an article of food: but this is an inconvenience which, by the oil being properly clarified and prepared at firſt, might be perhaps avoided. This oil is alſo exported both in its adulterated and original ſtate to Patna and other parts of the low country.

The author does not know any purpoſe to which

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‡ Vol. I. art. xiv.

the gum has ever been applied: but if found upon trial to be of uſe, he informs us that it might be collected in large quantities; and that the beſt ſeaſon for this would be in the months of March and April, about the time the flowers come out, when the tree ſeems to be moſt replete with it: ſuch an operation, indeed, would probably diminiſh its produce in the fruit and flower; but where it was ſufficiently cultivated, the loſs in thoſe could be but little felt.

The wood, from what has been already ſaid of it, cannot be expected to be often had in beams of any conſiderable length, ſo as to make it ſo very uſeful in building as it would otherwiſe be from its not being liable to be eat by the white ants; Mr Keir, however told our author, that when he was at Chowſee (a village upon the Caramnaſſa near Buxar), he had beams of it which were to the beſt of his remembrance above 20 feet long; but in many other reſpects it is a moſt uſeful wood; and as it is tough, and a ſtrong texture, it might perhaps be employed to advantage in ſhip-building; in which caſe if properly cultivated in many grounds that ſeem well adapted for it and fit for little elſe, it might thus in time become a valuable article in that branch at Calcutta, whither it could eaſily be tranſported during the rainy ſeaſon from almoſt any part of theſe countries, by ſeveral rivers that are then ſufficiently full to float it down.

The tree, it is ſaid, though it does not refuſe a rich ſoil, will grow in the moſt barren ground, even amongſt ſtones and gravel, where there is the leaſt appearance of a ſoil; and it ſeems to deſtroy all the ſmaller trees and bruſhwood about it. It does not require much moiſture, ſeeming to produce nearly as well in the drieſt as in moſt favourable years, and in every ſituation; and is therefore admirably fitted for the convenience of the inhabitants of theſe hilly countries, which are peculiarly ſubject to long and ſevere droughts during the hot months.

“ Yet, notwithſtanding its utility, and the immenſe quantity of ground that ſeems ſo well adapted to the growth of it, both here and in the neighbouring provinces of Catak, Pacheet, Rotas, &c. (greateſt part of which, indeed, ſeems fit for no other uſeful production) I have myſelf never obſerved (ſays our author), nor can I find any of my acquaintance who ever have remarked, one ſingle tree in its infant ſtate. We can ſee, every where, full grown trees in great abundance; but never meeting with any young plants, both I and all whom I have ſpoken to on the ſubject, are at ſome loſs to conceive how they ſhould have come here: neither can the country people themſelves, of whom I have inquired, give any rational account of this; although it appears pretty evident that numbers of them muſt have been cultivated ſome time or other, every village having many of them growing about it. This is a circumſtance which ſufficiently marks the true character of the lower order of natives in their moſt ſupine indolence and ſloth; owing chiefly, perhaps, to the ignorance and ſtupid rapacity of their Rajahs, Zemindars, and other landholders, and their total inattention to the welfare of thoſe dejected wretches from whom they derive their conſequence and power. Of their baſe indifference to the intereſts of thoſe whom they thus affect to hold beneath their regard, many ſtriking inſtances occurred to me in the courſe of my enquiries upon this very ſubject; and it was not long ago that, aſking ſome queſtions concerning the mahwah of a Zemindar in this neighbourhood, he anſwered, that “it was the food of the poor people, and how ſhould he know any thing about it.’

“ It was this ſtrange neglect of the culture of it, and a knowledge of its uſefulneſs (continues our author), which firſt led me to enquire into the nature of this tree, from which the bulk of the people hereabouts already draw ſuch great benefit, in order to know whether they might not increaſe it without any great trouble to themſelves; and whether thereby the revenue might not alſo be increaſed, and a certain proviſion be made againſt famines, from which the natives often ſuffer ſeverely in theſe higher diſtricts.

“ To effect this, it would be neceſſary to give the Ryots every poſſible encouragement to raiſe the tree from the ſeeds; but as the torpid apathy of theſe people, whether natural or acquired, will ever prevent their being moved to any exertion by a proſpect, however alluring, of diſtant advantage, I apprehend the only way of bringing this about would be making the planting and raiſing of a certain number of mahwahs (in proportion to the value of the tenure) an article in their kabooleats or agreements.

“ The tree, as has been already obſerved, will grow almoſt any where: it ought to be ſown about the beginning of the rains, either in beds (to be afterwards tranſplanted) or at about thirty or forty feet diſtance, in the ground deſigned for it. It is ſaid that in ſeven years the trees will give flowers and fruit; in ten, they will yield about half of their common produce; and that in twenty years they come to their full growth; after which, if my information be good, they will laſt near one hundred years. This account, I acknowledge, muſt neceſſarily be very vague and uncertain, as I never have met with a ſingle perſon who appeared to have had either opportunity or inclination to obſerve its progreſs. Such, however, is what the country people ſay of it.

“ I am told that a good tree will eaſily give four puckha maunds (about three hundred weight avoirdupois) of dried flowers, which will ſell here for about two rupees; and of ſeeds it will afford about two maunds; and this, of oil, will yield 26 ſeers puckha weight (near 60 lb.) which, in a year like this, when oil is cheap, will ſell at this place for two rupees more. It is to be obſerved, however, that every tree will not give ſo much, neither are the flowers and oil ſo clear in any part of the hills as at Chitra; but, allowing only a half of this or leſs, to be the product of each tree (though it might be rendered ſtill much greater by the very leaſt care and induſtry in the cultivation of it), within the ſpace of 20 years a ſubſiſtence might be raiſed to the inhabitants, and a conſiderable revenue to the proprietors of the lands throughout an immenſe tract of country; the greateſt part of which in its preſent ſtate, is little better than a barren waſte, and cannot pay one ſingle anna to the Zemindar or the government. That ſuch an advantage might be derived from it may be proved by the moſt moderate calculation: for ſuppoſing the trees to be ſown at 40 feet diſtance from each other on each begah (about the third of an acre) might ſtand eight trees; and ſuppoſing the product of each tree to be only half a rupee, there would be four rupees of annual value on a begah of ground; half of which going to the proprietor, it would thus give a far better rent than the generality of the beſt grounds in theſe parts; and the labourer would have a produce, without any other trouble than that of ſowing the ſeed, and fencing the ground whilſt the trees were young; and that of annually gathering the flowers and preparing the oil when they arrive at their proper ſize; and they would probably begin to give a produce within leſs than 10 years after the ſowing.

“ As this tree will yield nearly its uſual quantity of flowers and fruit in ſeaſons when, for want of rain, every other crop fails; if thus cultivated, it would afford the inhabitants a ſure and certain reſource, under the moſt dreadful, and what has hitherto been to them the moſt deſtructive of all calamities, famine. It is well known, that the rice and other ſorts of grain, which form the chief part of their ſuſtenance, require a conſiderable degree of moiſture to bring them to perfection; an unuſually dry ſeaſon deſtroys the harveſt in thoſe articles, and reduces the Ryots in general to the utmoſt miſery; a predicament into which they could hardly fall, even in the ſevereſt dearth of grain, whilſt they had plenty of the flowers and fruit of the mahwah to depend upon.”

MAIA, (fab. hiſt.), the daughter of Atlas and Pleione. She was the mother of Mercury by Jupiter. She was one of the Pleiades, the moſt luminous of the ſeven ſiſters; (ſee PLEIADES.) Alſo a ſurname of Cybele.

MAIDEN, an inſtrument for beheading criminals.

Of the uſe and form of this inſtrument Mr Pennant gives the following account. “It ſeems to have been confined to the limits of the foreſt of Hardwick, or the 18 towns and hamlets within its precincts. The time when this cuſtom took place is unknown; whether Earl Warren, lord of this foreſt, might have eſtabliſhed it among the ſanguinary laws then in uſe againſt the invaders of the hunting rights, or whether it might not take place after the woollen manufactures at Halifax began to gain ſtrength, is uncertain. The laſt is very probable; for the wild country around the town was inhabited by a lawleſs ſet, whoſe depredations on the cloth tenters might ſoon ſtifle he efforts of infant induſtry. For the protection of trade, and for the greater terror of offenders by ſpeedy execution, this cuſtom ſeems to have been eſtabliſhed, ſo as at laſt to receive the force of law, which was, ‘ That if a felon be taken within the liberty of the foreſt of Hardwick, with goods ſtolen out, or within the ſaid precincts, either hand-habend, back-berand, or confeſſioned, to the value of thirteen-pence halfpenny, he ſhall, after three market-days or meeting-days within the town of Halifax, next after ſuch his apprehenſion, and being condemned, be taken to the gibbet, and there have his head cut from its body.’

“The offender had always a fair trial; for as ſoon as he was taken, he was brought to the lord's bailiff at Halifax: he was then expoſed on the three markets (which here were held thrice in a week), placed in a ſtocks, with the goods ſtolen on his back, or, if the theft was of the cattle kind, they were placed by him; and this was done both to ſtrike terror into others, and to produce new informations againſt him. The bailiff then ſummoned four freeholders of each town within the foreſt to form a jury. The felon and proſecutors were brought face to face; the goods, the cow or horſe, or whatſoever was ſtolen, produced. If he was found guilty, he was remanded to priſon, had a week's time allowed for preparation, and then was conveyed to this ſpot, where his head was ſtruck off by this machine. I ſhould have premiſed that if the criminal, either after apprehenſion, or in the way to execution, could eſcape out of the limits of the foreſt (part being cloſe to the town), the bailiff had no farther power over him; but if he ſhould be caught within the precincts at any time after, he was immediately executed on his former ſentence.

“This privilege was very freely uſed during the reign of Elizabeth: the records before that time were loſt. Twenty-five ſuffered in her reign, and at leaſt twelve from 1623 to 1650; after which I believe the privilege was no more exerted.

“This machine of death is now deſtroyed; but I ſaw one of the ſame kind in a room under the parliament houſe at Edinburgh, where it was introduced by the regent Morton, who took a model of it as he paſſed through Halifax, and at length ſuffered by it himſelf. It is in form of a painter's eaſel, and about ten feet high: at four feet from the bottom is a croſs bar, on which the felon lays his head, which is kept down by another placed above. In the inner edges of the frame are grooves; in theſe is placed a ſharp ax, with a vaſt weight of lead, ſupported at the very ſummit with a peg; to that peg is faſtened a chord, which the executioner cutting, the ax falls, and does the affair effectually, without ſuffering the unhappy criminal to undergo a repetition of ſtrokes, as has beeen the caſe in the common method. I muſt add, that if the ſufferer is condemned for ſtealing a horſe or a cow, the ſtring is tied to the beaſt, which on being whipped, pulls out the peg, and becomes the executioner.”

MAIDEN is alſo the name of a machine firſt uſed in Yorkſhire, and ſince introduced into other places, for waſhing of linen; conſiſting of a tub 19 inches high, and 27 in diameter at the top, in which the linen is put, with hot water and ſoap, to which is adapted a cover, fitting it very cloſely, and faſtened to the tub by two wedges; through a hole in the middle of the cover paſſes an upright piece of wood, kept at a proper height by a peg above, and furniſhed with two handles, by which it is turned backward and forward: to the lower end of this upright piece is faſtened a round piece of wood, in which are fixed ſeveral pieces, like cogs of a wheel. The operation of this machine is to make the linen paſs and repaſs quick through the water

MAIDEN-Rents, in old writers, a noble paid by the tenants of ſome manors on their marriage. This was ſaid to be given to the lord for his omitting the cuſtom of marcheta, whereby he was to have the firſt night's lodging with his tenant's wife; but it ſeems more probably to have been a fine for a licence to marry a daughter.

MAIDENHEAD, a town of Berks, 26 miles from London, with a ſtone bridge over the Thames.

It is governed by a high-ſteward, a mayor, a ſteward, and 10 aldermen, out of which laſt two bridgemaſters are choſen every year. Here is a goal both for debtors and felons. The town ſtands partly in the pariſh of Bray and partly in that of Cookham; and here is a chapel peculiar to the corporation, the miniſter whereof is choſen by the inhabitants, and not obliged to attend the biſhop's viſitation. Here are ſeveral alms-houſes and charities. This town, now ſo conſiderable, did not begin to flouriſh till, by the building of its bridge, travellers were brought this way, who before uſed a ferry at that called *Babham's End*, two miles north of it. The barge pier-bridge is maintained by the corporation, for which they are allowed the tolls both over and under it. The bridge-pier divides Berks from Bucks. There is a great trade here in malt, meal, and timber, which they carry in their barges to London. As this is the great thoroughfare from thence to Bath, Briſtol, and other ſouth-weſt parts of England, the adjacent wood or thicket has been noted for many robberies. The market here is on Wedneſdays; there are three fairs; and here are frequent horſe-races.

MAIDSTONE, a town of Kent, in England, 36, miles from London, ſeated on the river Medway, a branch of which runs through it. It is a corporation, and ſends two members to parliament. Its chief trade, beſides linen-thread which it makes to great perfection, is in hops; of which there are great plenty of plantations about the town, as well as orchards of cherries. The tide flows quite up to the town, and brings up barges, &c. of 50 or 60 tons. It has a fine ſtone bridge. One of the public goals for the county is kept in this town; and the cuſtody of weights and meaſures, renewed by the ſtandard of King Henry VII. was committed to it by parliament, as being in the centre of Kent: for which reaſon the knights of the ſhire are always elected, and the courts of juſtice always held here, and generally the aſſizes. The archbiſhop of Canterbury is conſtant parſon of this pariſh, which is his peculiar, and ſerved by his curate. Here are four charity ſchools, in which are above 100 boys and girls, who are viſited once a week and catechiſed by the miniſter. This is ſuch a plentiful county, and the lands hereabouts are ſo rich, that London is ſupplied with more commodities from hence than from any market-town in England; particularly with the large bullocks that come from the Weald of Kent, which begins but ſix miles off; with timber, wheat, and great quantities of hops, apples, and cherries; with a ſort of paving-ſtone, eight or ten inches ſquare, that is exceeding durable; and with the fine white ſand for glaſs-houſes and ſtationers. There are ſo many gentlemens ſeats within 10 miles, that it is rare to find a town of ſo much trade and buſineſs ſo full of gentry and good company. The market here, which is the beſt in the county, is on Thurſday; it has another on the ſecond Tueſday of every month, granted them by George II. in 1751; and fairs on February 13th, May 12th, June 20th (called *Garlic fair*), and October 17th. Here was a college or hoſpital, erected by Archbiſhop Boniface; and a chantry, by Archbiſhop Thomas Arundel, which is now the free ſchool.

MAIENNE, a conſiderable, handſome, and populous town in France, with the title of a duchy; ſeated on a river of the ſame name, in W. Long. 0. 35. N. Lat. 48. 18.

MAIGNAN (Emanuel), a religious minim, and one of the greateſt philoſophers of his age, was born of an ancient and noble family at Thouloufe in 1601. Like the famous Paſcal, he became a complete mathematician without the aſſiſtance of a Teacher; and filled the profeſſor's chair at Rome in 1636, where, at the expence of Cardinal Spada, he publiſhed his book *De Perſpectiva Horaria.* He returned to Thoulouſe in 1650, and was created provincial: the king, who in 1660 entertained himſelf with the machines and curioſities in his cell, made him offers by Cardinal Mazarine, to draw him to Paris; but he humbly deſired to ſpend the remainder of his days in a cloyſter. He publiſhed a courſe of philoſophy, 4 vols 8vo, at Thoulouſe; to the ſecond edition of which he added two treatiſes, one againſt the vortices of Deſcartes, and the other on the ſpeaking trumpet invented by Sir Samuel Morland. He is ſaid to have ſtudied even in his ſleep, his very dreams being employed in theorems, the demonſtrations of which would awaken him with joy. He died in 1676.

MAJESTY, a title given to kings, which frequently ſerves as a term of diſtinction. The word ſeems compoſed of the two Latin words, *major* "greater," and *ſtatus* "ſtate." The emperor is called *Sacred Majeſty*, *Imperial Majeſty*, and *Cæſarean Majeſty*: The king of Hungary is ſtyled *His Apoſtolic Majeſty.* The king of Spain is termed *His moſt Catholic Majeſty*; and the king of Portugal, *His moſt Faithful Majeſty.* The king of France uſed to be called *His moſt Chriſtian Majeſty*; and when he treated with the emperor, the word *Sacred* was added: Lately plain *King of the French.*—With reſpect to other kings, the name of the kingdom is added; as *His Britannic Majeſty*, *His Poliſh Majeſty*, &c. Formerly princes were more ſparing in giving titles, and more modeſt in claiming them: before the reign of Charles V. the king of Spain had only the title of *Highneſs*; and before that of Hen. VIII. the kings of England were only addreſſed under the titles of *Grace* and *Highneſs*

Under the Roman republic, the title *Majeſty* (*majeſtas*) belonged to the whole body of the people, and to the principal magiſtrates; ſo that to diminiſh or wound the majeſty of the commonwealth, was to be wanting in reſpect to the ſtate or to its miniſters. But the power afterwards paſſing into the hands of a ſingle perſon, the appellation of *Majeſty* was transferred to the emperor and the imperial family. Pliny compliments Trajan on his being contented with the title of *Greatneſs*; and ~~ſpeaks~~ very invidiouſly of thoſe who affected that of *Majeſty.* And yet this laſt ſeems to be the moſt modeſt and juſt title that can be attributed to ſovereigns, ſince it ſignifies no more than the royalty or ſovereign power.

MAII INDUCTIO, an ancient cuſtom for the prieſt and people of country-villages to go in proceſſion to ſome adjoining wood on a May day morning; and return in a kind of triumph, with a May-pole, boughs, flowers, garlands, and other tokens of the ſpring. This May-game, or rejoicing at the coming of the ſpring, was for a long time obſerved, and ſtill is in ſome parts of England; but there was thought to be ſo much heathen vanity in it, that it was condemned and prohibited within the dioceſe of Lincoln by the good old biſhop Groſthead.

MAIL (*maille*), a term primarily applied to the meſhes or holes in net-work.

Coat of Mail. See Coat. It is called alſo a *habergeon*. Anciently they alſo wore ſhirts of mail under the waiſtcoat, to ſerve as a defence againſt ſwords and poniards. We alſo read of gloves of mail.

Mail, or *Mall*, alſo ſignifies a round ring of iron; whence the play of pall-mall, from *palla* "a ball," and *maille* "the round ring through which it is to paſs."

Mail, or *Maille*, in old writers, a ſmall kind of money. Silver half-pence were likewiſe termed *mailles*, 9 Hen. V. By indenture in the mint, a pound weight of old ſterling ſilver was to be coined in 360 ſterlings or pennies, or 720 *mails* or half-pennies, or 1440 farthings. Hence the word *mail* was derived, which is now vulgarly uſed in Scotland to ſignify an annual rent.

Mail, or *Maill*, on ſhip-board, a ſquare machine compoſed of a number of rings interwoven net-wiſe, and uſed for rubbing off the looſe hemp which remains on lines or white cordage after it is made.

Mail is likewiſe uſed for the leather bag wherein letters are carried by the poſt.

Mail-Coaches. See Coach.

Action of Mails and Duties, in Scots law. See Law, p. 699, § 7. and p. 712, § 20.

Mail (*Black*). See *Black-Mail*.

MAILLA (Joſeph-Anne Marie de Moyriac de), a learned Jeſuit, was born in the caſtle of Maillac in the Bugey, and appointed a miſſionary to China, whither he went in 1703. At the age of 28 he had acquired ſo great ſkill in the characters, arts, ſciences, mythology, and ancient books of the Chineſe, as to aſtoniſh even the learned. He was greatly beloved and eſteemed by the emperor Kam-hi, who died in 1722. He, together with other miſſionaries, was employed by that prince to draw a chart of China and Chineſe Tartary, which was engraved in France in the year 1732. He drew likewiſe particular charts of ſome of the provinces of this vaſt empire; with which the emperor was ſo pleaſed, that he ſettled the author at his court. The great annals of China were alſo tranſlated into French by Father Mailla, and his manuſcript was tranſmitted to France in 1737. This work was publiſhed in 12 volumes quarto, under the inſpection of M. Groſier, and is the firſt complete hiſtory of that extenſive empire. The ſtyle, which was full of hyperbole and bombaſt, has been reviſed by the editor, and the ſpeeches which extended to too great a length, and had too much ſameneſs in them, have been omitted. Father Mailla, after having reſided 45 years in China, died at Pekin on the 28th of June 1748, in the 79th year of his age. Kien-Lung the reigning emperor paid the expences of his funeral. He was a man of a lively and gentle character, capable of the moſt perſevering labour and the moſt unremitting activity.

MAILLET (Benoit de), deſcended from a noble family in Lorrain, was born in 1659, and appointed, at the age of 33, conſul general for Egypt. He fulfilled this office for 16 years with great ability, ſupported the king's authority againſt the janizaries, and greatly extended the trade of France into that part of Africa. As a recompence for his ſervices, the king beſtowed upon him the conſulſhip of Leghorn, which is the firſt and moſt conſiderable conſulſhip in his gift. Being at laſt appointed in 1715 to viſit the ſea-ports in the Levant and on the coaſt of Barbary, he was ſo ſucceſsful in the execution of his commiſſion, that he obtained permiſſion to retire with a conſiderable penſion. He ſettled at Marſeilles; where he died in 1738, in the 79th year of his age. He was a man of a lively imagination, and gentle manners; in ſociety he was very amiable, and he poſſeſſed the ſtricteſt probity. He was fond of praiſe, and very anxious about the reputation of genius. During the whole of his life he paid particular attention to the ſtudy of natural hiſtory; and his principal object was to become acquainted with the origin of our globe. On this important ſubject he left ſome curious obſervations, which have been publiſhed in octavo under the title of *Telliamed*, which is the name *de Maillet* written backwards. The editor Abbé Maſcrier has given to this work the form of a dialogue. An Indian philoſopher is introduced as explaining to a French miſſionary his opinion concerning the nature of the globe, and the origin of mankind: and, which is very incredible, he ſuppoſes it to have come out of the waters, and makes an abode uninhabitable by man the birthplace of the human race. His great object is to prove, that all ſtrata of which this globe is compoſed, even to the tops of the higheſt mountains, have come from the boſom of the waters; that they are the work of the ſea, which continually retires to allow them gradually to appear. Telliamed dedicated his book to the illuſtrious Cyrano de Bergerac author of the imaginary "Travels to the ſun and moon." In the humorous epiſtle which is addreſſed to him, the Indian philoſopher informs us that theſe dialogues are nothing but a collection of dreams and fancies. He cannot be accuſed of having broken his word; but he may well be reproached with not having written them in the ſame ſtyle with this letter to Cyrano, and with not having diſplayed equal livelineſs and humour. A ſubject the moſt extravagant is handled in the graveſt manner, and his ridiculous opinion is delivered with all the ſerious air of a philoſopher. Of the ſix dialogues which compoſe the work, the four firſt contain many curious obſervations truly philoſophical and important: in the other two we find nothing but conjectures, fancies, and fables, ſometimes amuſing, but always abſurd. To Maillet we are indebted alſo for "A deſcription of Egypt," collected from his memoirs by the editor of Telliamed, 1743, 4to, or in 2 vols 12mo.

MAIM, maihem, or *Mayhem*, in law, a wound by which a perſon loſes the uſe of a member that might have been a defence to him; as when a bone is broken, a foot, hand, or other member cut off, or an eye put out; though the cutting off an ear or noſe, or breaking the hinder-teeth, was formerly held to be no maim. A maim by caſtration was anciently puniſhed with death, and other maims with loſs of member for member; but afterwards they were only puniſhed by fine and impriſonment. It is now enacted by the ſtatute 21 & 23 Car. II. that if any perſon, from malice afore-

aforethought, ſhall diſable any limb or member of any of the king's ſubjects with an intent to diſfigure him, the offender, with his aiders and abettors, ſhall be guilty of felony without benefit of clergy; though no ſuch attainder ſhall corrupt the blood, or occaſion forfeiture of lands, &c.

MAIMBOURG (Louis), born at Nanci in 1610, became a Jeſuit in 1626; and acquired reputation as a teacher, but yet more by the many hiſtories which he publiſhed. The Janſeniſts criticiſed his hiſtory of Arianiſm, and that of the *Iconoclaſtes;* and his hiſtory of Calviniſm, publiſhed in 1681, ſtirred up a violent paper-war againſt him, the operations whereof he left entirely to his enemies, without giving himſelf any trouble offenſively or defenſively. He was degraded by the general of the Jeſuits, on account of his having declared too boldly in favour of the Gallican church againſt the Ultramountains. He retired into the abbey of St Victor, where he died in 1686.

He ought not to be be confounded with *Theodore Maimbourg* his couſin; who embraced Calviniſm, afterwards returned to the Romiſh church, returned back to the reformed religion, embraced Socinianiſm, and died at London about the year 1693, after having publiſhed ſome works.

MAIMONIDES (Moſes), or MOSES THE SON OF MAIMON, a celebrated rabbi, called by the Jews *the eagle of the doctors,* was born of an illuſtrious family at Cordova in Spain, in 1131. He is commonly named *Moſes Ægyptius,* becauſe he ſettled in Egypt, where he ſpent his whole life in quality of phyſician to the ſultan. Here he opened a ſchool, which was ſoon filled with pupils from all parts; from Alexandria and Damaſcus eſpecially, whoſe proficiency under him ſpread his fame all over the world. He was no leſs eminent in philoſophy, mathematics, and divinity, than in medicine. Caſaubon affirms it may be truly ſaid of him, as Pliny of old ſaid of Diodorus Siculus, that "he was the firſt of his tribe who ceaſed to be a trifler." It would be tedious to enumerate all the works of Maimonides; ſome were written originally in Arabic, but are now extant only in Hebrew tranſlations, "Thoſe (ſays Collier), who deſire to learn the doctrine and the canon law contained in the Talmud, may read Maimonides's compendium of it in good Hebrew, in his book intitled *Iad;* wherein they will find great part of the fables and impertinencies in the Talmud entirely diſcarded. But the *More Nevochim* is the moſt valued of all his works; deſigned to explain the obſcure words, phraſes, metaphors, &c. in ſcripture, which, when literally interpreted, have either no meaning or appear abſurd.

MAIN, an epithet uſually applied by ſailors to whatever is principal, as oppoſed to whatever is inferior or ſecondary. Thus the main land is uſed in contradiſtinction to an iſland or peninſula; and the main-maſt, the main-wale, the main-keel, and the main-hatchway, are in like manner diſtinguiſhed from the fore and mizen maſts, the channel-wales, the falſe keel, and the fore and after hatchways, &c.

MAINOUR, MANOUR, or *Meinour* (from the French *manier,* i. e. *manu tractare),* in a legal ſenſe denotes the thing that a thief taketh away or ſtealeth; As to be taken with the mainour (*Pl. Cor.* fol. 179.), is to be taken with the thing ſtolen about him: And again (fol. 194.) it was preſented, that a thief was delivered to the ſheriff or viſcount, together with the mainour: And again (fol. 186.), if a man be indicted, that he feloniouſly ſtole the goods of another, where, in truth, they are his own goods, and the goods he brought into the court as the mainour; and if it be demanded of him, what he ſaith to the goods, and he diſclaim them; though he be acquitted of the felony, he ſhall loſe the goods: And again (fol. 149.), if the defendant were taken with the manour, and the manour be carried to the court, they, in ancient times, would arraign him upon the manour, without any appeal or indictment. Cowel. See Black. Comment. Vol. III. 71. Vol. IV. 303.

MAINPRIZE. See *Falſe* IMPRISONMENT.

The writ of mainprize, *manucaptio,* is a writ directed to the ſheriff (either generally, when any man is impriſoned for a bailable offence, and bail hath been refuſed; or ſpecially, when the offence or cauſe of commitment is not properly bailable by law), commanding him to take ſureties for the priſoner's appearance, uſually called *mainpernors,* and to ſet him at large. Mainpernors differ from bail, in that a man's bail may impriſon, or ſurrender him up before the ſtipulated day of appearance; mainpernors can do neither, but are barely ſureties for his appearance at the day: bail are only ſureties that the parties be anſwerable for the ſpecial matter for which they ſtipulate, mainpernors are bound to produce him to anſwer all charges whatever. See *HABEAS Corpus.*

MAINTENANCE, in law, bears a near relation to BARRETRY; being an officious intermeddling in a ſuit that no way belongs to one, by maintaining or aſſiſting either party with money or otherwiſe, to proſecute or defend it: a practice that was greatly encouraged by the firſt introduction of uſes. This is an offence againſt public juſtice, as it keeps alive ſtrength and contention, and prevents the remedial proceſs of the law into an engine of oppreſſion. And therefore, by the Roman law, it was a ſpecies of the *crimen falſi,* to enter into the confederacy, or do any act to ſupport another's law-ſuit, by money, witneſſes, or patronage. A man may, however, maintain the ſuit of his near kinſman, ſervant, or poor neighbour, out of charity and compaſſion, with impunity. Otherwiſe the puniſhment by common law is fine and impriſonment; and by the ſtatute 32 Hen. VIII. c. 9. a forfeiture of 10 l.

MAINTENON (Madame de), a French lady of extraordinary fortune, deſcended from an ancient family, and whoſe proper name was *Frances Daubigne,* was born in 1635. Her parents by misfortunes being ill able to ſupport her, ſhe fell to the care of her mother's relations; to eſcape which ſtate of dependance, ſhe was induced to marry that famous old buffoon the Abbé Scarron, who ſubſiſted himſelf only on a penſion allowed him by the court for his wit and parts. She lived with him many years, which Voltaire makes no ſcruple to call the happieſt years of her life; but when he died in 1660, ſhe found herſelf as indigent as ſhe was before her marriage. Her friends indeed endeavoured to get her huſband's penſion continued to her, and preſented ſo many petitions to the king about it, all beginning with "The widow Scarron moſt humbly prays your majeſty's, &c." that he was quite weary of them; and has been heard to exclaim, "Muſt I always be peſtered with the widow Scarron?" At laſt, however, through the recommendation of Madame de Monteſpan, he ſettled a much larger penſion on her, with a genteel apology for making her wait ſo long; and afterwards made choice of her to take care of the education of the young duke of Maine, his ſon by Madame de Monteſpan. The letters ſhe wrote on this occaſion charmed the king, and were the origin of her advancement; her perſonal merit effected all the reſt. He bought her the lands of Maintenon, the only eſtate ſhe ever had; and finding her pleaſed with the acquiſition, called her publicly *Madam de Maintenon*; which was of great ſervice to her in her good fortune, by releaſing her from the ridicule attending that of Scarron. Her elevation was to her only a retreat; the king came to her apartment every day after dinner, before and after ſupper, and continued there till midnight: here he did buſineſs with his miniſters, while Madam de Maintenon, employed in reading or needlework, never ſhowed any deſire to talk of ſtate-affairs, and carefully avoided all appearance of cabal or intrigue; ſhe did not even make uſe of her power to dignify her own relations. About the latter end of the year 1685, Louis XIV. married her, he being then in his 48th and ſhe in her 50th year; and that piety with which ſhe inſpired the king to make her a wife inſtead of a miſtreſs, became by degrees a ſettled diſpoſition of mind. She prevailed on Louis to found a religious community at St Cyr, for the education of 300 young ladies of quality; and here ſhe frequently retired from that melancholy of which ſhe complains ſo pathetically in one of her letters, and which few ladies will ſuppoſe ſhe ſhould be liable to in ſuch an elevated ſituation. But as M. Voltaire ſays, if any thing could ſhow the vanity of ambition, it would certainly be this letter. Madam de Maintenon could have no other uneaſineſs than the uniformity of her manner of living with a great king; and this made her once ſay to the count D'Aubigné her brother "I can hold it no longer; I wiſh I was dead." The anſwer he made to her was, "You have then a promiſe to marry the Almighty!" Louis, however, died before her in 1715; when ſhe retired wholly to St Cyr, and ſpent the reſt of her days in acts of devotion; and what is moſt ſurpriſing is, that her huſband left no certain proviſion for her, recommending her only to the duke of Orleans. She would accept no more than a penſion of 80,000 livres, which was punctually paid her till ſhe died in 1719. A collection of her letters has been publiſhed, and tranſlated into Engliſh; from which familiar intercourſes her character will be better known than from deſcription.

MAJOR, in the art of war, the name of ſeveral officers of very different ranks and functions.

MAJOR-General. See GENERAL.

MAJOR of a Regiment of Foot, the next officer to the lieutenant-colonel, generally promoted from the eldeſt captain: he is to take care that the regiment be well exerciſed, to ſee it march in good order, and to rally it in caſe of being broke in action: he is the only officer among the infantry that is allowed to be on horſeback in time of action, that he may the more readily execute the colonel's orders.

MAJOR of a Regiment of Horſe, as well as foot, ought to be a man of honour, integrity, underſtanding, courage, activity, experience, and addreſs: he ſhould be maſter of arithmetic, and keep a detail of the regiment in every particular: he ſhould be ſkilled in horſemanſhip, and ever attentive to his buſineſs: one of his principal functions is, to keep an exact roſter of the officers for duty: he ſhould have a perfect knowledge in all the military evolutions, as he is obliged by his poſt to inſtruct others, &c.

Town-MAJOR, the third officer in order in a garriſon, and next to the deputy-governor. He ſhould underſtand fortification, and has a particular charge of the guards, rounds, patroles, and centinels.

Brigade-MAJOR, is a particular officer appointed for that purpoſe only in camp: he goes every day to head-quarters to receive orders from the adjutant-general: there they write exactly whatever is dictated to them: from thence they go and give the orders, at the place appointed for that purpoſe, to the different majors or adjutants of the regiments which compoſe that brigade, and regulate with them the number of officers and men which each are to furniſh for the duty of the army; taking care to keep an exact roſter, that one may not give more than another; and that each march in their tour: in ſhort, the major of brigade is charged with the particular detail in his own brigade, in much the ſame way as the adjutant-general is charged with the general detail of the duty of the army. He ſends every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade miſſing at the retreat, or a report expreſſing that none are abſent: he alſo mentions the officers abſent with or without leave.

As all orders paſs through the hands of the majors of brigade, they have infinite occaſions of making known their talents and exactneſs.

MAJOR of Artillery, is alſo the next officer to the lieutenant-colonel. His poſt is very laborious, as the whole detail of the corps particularly reſts with him; and for this reaſon all the non-commiſſioned officers are ſubordinate to him, as his title of *ſerjeant-major* imports; in this quality they muſt render him an exact account of every thing which comes to their knowledge, either regarding the duty or wants of the artillery and ſoldiers. He ſhould poſſeſs a perfect knowledge of the power of artillery, together with all its evolutions. In the field he goes daily to receive orders from the brigade-major, and communicates them with the parole to his ſuperiors, and then dictates them to the adjutant. He ſhould be a very good mathematician, and be well acquainted with every thing belonging to the train of artillery, &c.

MAJOR of Engineers, commonly in Britain called *Sub-directors*, ſhould be very well ſkilled in military architecture, fortification, gunnery, and mining. He ſhould know how to fortify in the field, to attack and defend all ſorts of poſts, and to conduct the works in a ſiege, &c. See ENGINEER.

Aid-MAJOR, is on ſundry occaſions appointed to act as major, who has a pre-eminence above others of the ſame denomination. The horſe and foot-guards have their guidons, or ſecond and third majors.

Serjeant-MAJOR, is a non-commiſſioned officer, of great merit and capacity, ſubordinate to the adjutant as he is to the major. See SERJEANT.

DRUM-Major, is not only the firſt drummer in the regiment

regiment, but has the ſame authority over his drummers as the corporal has over his ſquad. He inſtructs them in their different beats; is daily at orders with the ſerjeants, to know the number of drummers for duty. He marches at their head when they beat in a body. In the day of battle, or at exerciſe, he muſt be very attentive to the orders given him, that he may regulate his beats according to the movements ordered.

Fife-Major, is he that plays the beſt on that inſtrument, and has the ſame authority over the fifers as the drum-major has over the drummers. He teaches them their duty, and appoints them for guards, &c.

Major, in law, a perſon who is of age to manage his own affairs. By the civil law a man is not a major till the age of 25 years; in England, he is a major at 21, and in Normandy at 20.

Major, in logic, is underſtood of the firſt propoſition of a regular ſyllogiſm. It is called *major*, becauſe it has a more extenſive ſenſe than the minor propoſition, as containing the principal term. See Logic.

Major and *Minor*, in muſic, are applied to concords which differ from each other by a ſemi-tone. See Concord.

Major-tone is the difference between the fifth and fourth; and major ſemi-tone the difference between the major fourth and the third. The major tone ſurpaſſes the minor by a comma.

Major-Domo, an Italian term, frequently uſed to ſignify a ſteward or maſter of the houſhold. The title *major domo* was formerly given in the courts of princes to three different kinds of officers. 1. To him who took care of what related to the prince's table, or eating; otherwiſe called *eleater*, *præfectus menſæ*, *architriclinus*, *dapifer*, and *principes coquorum*.—2. Major-domo was alſo applied to the ſtewards of the houſhold.—3. The title of major-domo was alſo given to the chief miniſter, or him to whom the prince deputed the adminiſtration of his affairs, foreign and domeſtic, relating to war as well as peace. Inſtances of major-domos in the two firſt ſenſes are frequent in the Engliſh, French and Norman affairs.

MAJOR (John), a ſcholaſtic divine and hiſtorian, was born at Haddington, in the province of Eaſt Lothian in Scotland. It appears from ſome paſſages in his writings, that he reſided a while both at Oxford and Cambridge. He went to Paris in 1493, and ſtudied in the college of St Barbe, under the famous John Boulac. Thence he removed to that of Montacute, where he began to ſtudy divinity under the celebrated Standouk. In the year 1498, he was entered of the college of Navarre, In 1505, he was created doctor in divinity; returned to Scotland in 1519, and taught theology during ſeveral years in the univerſity of St Andrew's. But at length, being diſguſted with the quarrels of his countrymen, he went back to Paris, and reſumed his lectures in the college of Montacute, where he had ſeveral pupils, who afterwards became men of great eminence. About the year 1530, he returned once more to Scotland, and was choſen profeſſor of theology at St Andrew's of which he afterwards became provoſt; and there died in 1547, aged 78. His logical treatiſes form one immenſe folio; his commentary on Ariſtotle's phyſics makes another; and his theological works amount to ſeveral volumes of the ſame ſize. Theſe maſſes of crude and uſeleſs diſquiſition were the admiration of his cotemporaries. A work, leſs prized in his own age, was to make him know to poſterity. His book *De Geſtis Scotorum*, was firſt publiſhed at Paris by Badius Aſcenſius, in the year 1521. He rejects in it ſome of the fictions of former hiſtorians; and would have had greater merit if he had rejected more. He intermingles the hiſtory of England with that of Scotland; and has incurred the cenſure of ſome partial writers, for giving an authority to the authors of the former nation, which he refuſes to thoſe of his own. Bede, Caxton, and Froiſſard, were exceedingly uſeful to him. What does the greateſt honour to this author is, the freedom with which he has cenſured the rapacity and indolence of eccleſiaſtics, and the ſtrain of ridicule with which he treats the pope's ſupremacy. The ſtyle in which he wrote does not deſerve commendation. Biſhop Spotiſwood calls it *Sorbonnic* and *barbarous*.

MAJORCA, an iſland of the Mediteranean, lying between Yvica on the weſt and Minorca on the eaſt. Theſe three iſlands were anciently called *Baleares*, ſuppoſed to be from the ſkill of their inhabitants in ſlinging, for which they were very remarkable. Originally they belonged to the Carthaginians; but during the wars of that people with the Romans, they ſeem to have regained their liberty. In 122 B. C. they were ſubdued by Metellus the Roman conſul, who treated the inhabitants with ſuch cruelty, that out of 30,000 he ſcarce left 1000 alive. He then built two cities on Majorca; one called *Palma*, now *Majorca*, to the eaſt: the other to the weſt, named *Pollentia*, now no longer in being. The iſland continued ſubject to the Romans, and to the nations who over-ran the weſtern part of the empire; for many ages. At laſt it was ſubdued by the Moors about the year 800. By them the iſland was put in a much better condition than it ever was before or ſince. The Moors being very induſtrious, and alſo populous, ſurrounded the whole coaſt with fortifications, that is, with a kind of towers and lines between them; cultivated every ſpot in the iſland that was not either rock or ſand; and had no fewer than 15 great towns, whereas now there are not above three. Neither was it at all difficult for the Mooriſh monarch to bring into the field an army much ſuperior in number to the inhabitants that are now upon it, taking in all ranks, ſexes, and ages. In 1229, the iſland was ſubdued by the king of Arragon, who eſtabliſhed in it a new kingdom, feudatory to that of Arragon, which was again deſtroyed in 1341 by the ſame monarchs; and ever ſince, the iſland hath been ſubject to Spain, and hath entirely loſt its importance. It is about 60 miles long, and 45 broad. The air is clear and temperate, and, by its ſituation, the heat in ſummer is ſo qualified by the breezes, that it is by far the moſt pleaſant of all the iſlands in the Mediterranean. There are ſome mountains; but the country is generally flat, and of ſuch an excellent ſoil, that it produces great quantities of corn as good in its kind as any in Europe. Oil, wine, and ſalt, are very plentiful, as alſo black cattle and ſheep; but deer, rabbits, and wild-fowl, abound ſo much, that they alone are ſufficient for the ſubſiſtence of the inhabitants. There are no rivers, but a great many ſprings and wells, as well as ſeveral good harbours. The inhabitants are robuſt, active, and good ſeamen.

Majorca, Mairan.

MAJORCA, a handſome, large rich, and ſtrong town, in the iſland of the ſame name, with a biſhops's ſee. It contains about 6000 houſes, and 22 churches, beſides the cathedral. The ſquares, the cathedral, and the royal palace, are magnificent ſtructures. A captain-general reſides there, who commands the whole iſland; and there is a garriſon againſt the incurſion of the Moors. It was taken by the Engliſh in 1706; but was retaken in 1715, ſince which time it has been in the hands of the Spaniards. It is ſeated on the ſouth-weſt part of the iſland, where there is a good harbour, 70 miles north-eaſt of Yvica, 120 ſouth-eaſt of Barcelona, 140 eaſt of Valencia, and 300 from Madrid. E. Long. 2. 56. N. Lat. 39. 36.

MAIRAN (Jean-Jacques d'Ortous de), deſcended from a noble family at Beſiers, was born in that city in 1678, and died at Paris of a defluxion of the lungs on the 20th of February 1771, at the age of 93. He was one of the moſt illuſtrious members of the academy of ſciences and of the French academy. Being early connected with the former ſociety, he, in the year 1741, ſucceeded Fontenelle in the office of ſecretary. This ſtation he filled with the moſt diſtinguiſhed ſucceſs till the year 1744; and, like his predeceſſor, poſſeſſed the faculty of placing the moſt abſtract ſubjects in the cleareſt light; a talent which is very rare, but which appears conſpicuous in all his works. The chief of them are, 1. *Diſſertation ſur la Glace*, the laſt edition of which was printed in 1749, 12mo. This excellent little tract has been tranſlated into German and Italian. 2. *Diſſertation ſur la cauſe de la lumiere des Phoſphores*, 1717, 12mo. 3. *Traité hiſtorique & phyſique de l'Aurore Boréale*, firſt publiſhed in 12mo 1733, and afterwards much enlarged and printed in 4to in 1754. The ſyſtem embraced by the author is liable to be controverted; but the book diſplays great taſte and erudition. 4. *Lettre au Pere Pareniun. contenant diverſes queſtions ſur la Chine*, 12mo. This is a very curious work, and is full of that philoſophical ſpirit which characteriſes the author's other publications. 5. A great number of papers in the memoirs of the academy of ſciences (ſince 1719), of which he publiſhed ſome volumes. 6. Several Diſſertations on particular ſubjects, which form only ſmall pamphlets. 7. The *Eloges* of the Academicians of the Academy of Sciences, who died in 1741, 1742, 1743, in 12mo. 1747. Without imitating Fontenelle, the author attained almoſt equal excellence by his talent of diſcriminating characters, appreciating their worth, and giving them their due ſhare of praiſe, without at the ſame time concealing their defects.

Mairan's reputation extended itſelf into foreign countries. He was a member of the imperial academy at Peterſburgh, of the royal academy of London, of the inſtitution at Bologne, of the royal ſocieties of Edinburgh and Upſal, &c. The gentleneſs and ſweetneſs of his manners made him be conſidered as a perfect model of the ſocial virtues. He poſſeſſed that amiable politeneſs, that agreeable gaiety, and that ſteady firmneſs, which never fail to procure love and eſteem. But we muſt add, ſays M. Saverien, that every thing had a reference to himſelf; ſelf-love and a regard to his own reputation were the motives of all his actions. He was deeply affected with cenſure or applauſe, and yet he had many friends. Uniting much gentleneſs of diſpoſition to an ingenious and agreeable expreſſion of countenance, he poſſeſſed the art of inſinuating himſelf into the good graces of others, ſo as to have the way to elevation and ſucceſs. He was honoured with protection and particular marks of regard by the duke of Orleans the regent, who bequeathed to him his watch in his will. The prince of Conti loaded him with favours: and the chancellor Dagueſſeau, obſerving in him great originality and ingenuity of thought, appointed him preſident of the *Journal des Sçavans*; a ſtation which he filled very much to the ſatiſfaction of the public and of the learned. The private and ſelfiſh views imputed to him by M. Saverien never made him deficient in what was due to the ſtricteſt probity. An expreſſion of his is remembered, which could have proceeded only from ſentiment; "An honeſt man (ſaid he) is one whoſe blood is refreſhed with the recital of a good action." He was ready at repartee. One day he happened to be in company with a gentleman of the gown, and to differ with him in opinion upon ſome point which had no more connection with juriſprudence than with geometry. "Sir (ſaid the magiſtrate, who ſuppoſed that a learned man was a perfect idiot out of his own ſphere), we are not now talking of Euclid or Archimedes"—"No, nor of Cujas nor Barthole!" replied the academician.

Maire, Maiſtre.

MAIRE (Streights le), a paſſage to Cape Horn, ſituated between Terra del Fuego and Staten iſland; which, being diſcovered by le Maire, obtained his name. It is now, however, leſs made uſe of than formerly, ſhips going round Staten Iſland as well as Terra del Fuego.

MAISTRE (Louis-Iſaac le), better known by the name of *Sacy*, was born at Paris in 1613. His genius very early diſcovered itſelf. After an excellent courſe of ſtudy under the direction of the abbot of ſaint Cyran, he was raiſed to the prieſthood in 1648, and ſoon after was choſen, on account of his virtues, to be director of the religious of Port Royal des Champs. As this monaſtery bore the reputation of Janſeniſm, their enemies were furniſhed with a pretence for perſecuting them. In 1661 the director was obliged to conceal himſelf; and in 1666 he was committed to the Baſtile. During his confinement he compoſed the book *Figures de la Bible*; in which, according to the Moliniſts, alluſions are made to the ſufferings endured by the Janſeniſts. If we may believe a Jeſuit writer, the gentlemen of Port Royal and thoſe who oppoſed their errors are repreſented in the 92d figure, the former by David, the latter by Saul. Rehoboam in the 116th figure, Jezebel in the 130th, Ahaſuerus in the 148th and 150th, and Darius in the 160, in the opinion of this author, repreſent Louis XIV. The writer of theſe anecdotes, of which we do not anſwer for the authenticity, adds, that when Sacy wiſhed to reproach his perſecutors, he always did it by means of the holy fathers. If this is the key to thoſe enigmatical portraits and alluſions, which it is pretended are to be found in that book, certain we are it was not diſcovered by the ſpirit of charity. Beſides, it is not certain that Sacy was the author of that book; for it is much more probable that it was compoſed by Nicholas Fontaine his fellow priſoner.

To Sacy's confinement the public are indebted for a French tranſlation of the Bible. This work was finiſhed in 1668, the evening before the feaſt of All Saints; on which day he recovered his liberty, after an impriſonment of two years and a half. He was preſented to the king and the miniſter; and all the favour he aſked from them was, that they would ſend ſeveral times a-year to examine the ſtate of the priſoners in the Baſtile. Le Maiſtre continued at Paris till 1675, when he retired to Port-Royal, which he was obliged to leave in 1679. He went to ſettle at Pompone, where he died January 4th 1684, at the age of 71. From him we have 1. *La Traduction de la Bible*, with explanations of the ſpiritual and literal meaning taken from the fathers, the greater part of which was done by du Foſſé, Huré, and Tourneux. This is the beſt French tranſlation which has yet appeared, and the moſt eſteemed edition is that of Paris in 32 volumes 8vo, 1682 and following years. The author tranſlated the New Teſtament three times, becauſe the firſt time the ſtyle of it appeared too much laboured and too refined, and the ſecond too ſimple. A counterfeit of the edition in 32 vols 8vo, was publiſhed at Bruſſels in 40 vols 12mo. The beſt editions of this verſion have been publiſhed at Bruſſels in 1700, in 3 vols 4to; at Amſterdam, under the name of *Paris*, 1711, 8 vols in 12mo; at Paris 1713, in 2 vols 4to; and in 1715, with notes and a concordance, 4 vols folio. 2 *Une Traduction des Pſeaumes ſelon l'Hebreu & la Vulgate*, in 12mo. 3. *Une Verſion des Homelies de St Chryſoſtome ſur St Matthieu*, in 3 vols 8vo. 4. *La Traduction de l'Imitation de Jeſus Chriſt (ſous le nom de Beuil, prieur de Saint-Val)*, Paris 1663, 8vo. 5. *Celle de Phedre*, 12mo. *(ſous le nom de St Aubin)*. 6. *De trois Comédies de Térence*, in 12mo. *Des Lettres de Bongars (ſous le nom de Brianville)*. 8. *Du Poëme de St Proſper ſur les ingrates*, in 12mo. *en verſe & en proſe*. 9. *Les Enluminures de Almanach des Jéſuites*, 1654, 12mo. reprinted in 1733. In 1653 there appeared a print repreſenting the overthrow of Janſeniſm anathematiſed by the two powers, and the confuſion of the diſciples of the biſhop of Ypres, who are going to ſeek refuge with the Calviniſts. The monks of Port-Royal were greatly provoked at this print, and Sacy thought that he would lower its reputation by means of his *Enluminures*, which Racine has ridiculed in one of his letters. It is indeed very ſtrange, that men of taſte and piety ſhould write ſatires to the injury of one another. 10. *Heures de Port-Royal*, in 12mo. 11. *Lettres de Piété*, Paris 1690, 2 vols 8vo.

MAITLAND (Sir Richard), a Scottiſh poet and eminent public character, who flouriſhed during the greateſt part of the 16th century. The ancient name of the family was *Mautalant*; and the firſt who diſtinguiſhed the houſe was an old Sir Richard, famous for his valour, who lived ſome time ſubſequent to the middle of the 13th century. He was then baron or laird of Thirlſtane in Haddingtonſhire. In 1346 the family muſt have been eminent; for in that year John Maitland of Thirlſtane married Agnes daughter of Patrick earl of March. On the 28th January, 1432, William Maitland of Thirlſtane obtained from Archibald duke of Touraine and earl of Douglas a grant of the lands of Blyth and others—William, the father of our poet, and who (while his father John Maitland of Thirlſtane was yet alive) firſt had the title of Lethington, married Martha daughter of George Lord Seaton, and was killed at Flodden in 1513.

Sir Richard was born in 1496; was educated at St Andrew's; and went to France to ſtudy the laws. Upon his return, ſays Mackenzie, he became a favourite of James V. and in the books of ſederunt is marked an extraordinary lord of ſeſſion in 1553. By a letter of James VI. it appears that Sir Richard had ſerved his grandſir, goodſir, goodam, his mother, and himſelf, faithfully in many public offices. He unhappily became blind before 1561, or his 65th year: but notwithſtanding, he was made ſenator of the college of Juſtice, by the title of Lord Lethington, 12th Nov. 1561; and on the 20th Dec. 1562, one of the counſel and lord-privy ſeal which laſt office he held till 1567, when he reſigned it in favour of John his ſecond ſon. Sir Richard continued a lord of ſeſſion during all the troubleſome times of the regents in the minority of James VI. till 1584, when he reſigned; and died 20th March 1586. By Mary his wife, daughter of Thomas Cranſton of Corſly, he had ſeven children of whom three were ſons: 1. William, the famous ſecretary; Sir John, afterward Lord Thirlſtane and chancellor; and, 3. Thomas, who is the prolocutor with Buchanan in his treatiſe *De Jure Regni*.—Sir Richard is never mentioned by writers but with reſpect as a man of great talents and virtue. Knox indeed blames him for taking a ſum of money, to ſuffer Cardinal Beaton to eſcape when impriſoned at Seaton. But Knox (Mr Pinkerton obſerves) was too vehement, and often blamed without cauſe.—One poem of Sir Richard's was publiſhed in the Evergreen; but no more of his works appeared till they were inſerted in the Collection in 2 vols publiſhed ſome years ago by Mr Pinkerton. Beſides poems, he wrote a MS. (formerly, as Dr Mackenzie ſhows, in the earl of Winton's library), the title of which was, "The Chronicle and Hiſtorie of the Houſe and Surname of Seaton, unto the moneth of November, in the yier of God An Thuſand Five Hundereth Fifty Aught yiers. Collectit, writ, and ſet furth, be Sir Richard de Maitland of Leithingtoun, knicht, doughter-ſone of the ſaid hous." Mackenzie gives an account of it.—Mr Forbes, in the preface to his Deciſions, tells us there is ſtill a MS. of the deciſions from 15th December 1550 till 30th July 1565 by our author, folio, in the advocates library.

MAITLAND (John), Lord Thirlſtane, chancellor of Scotland, was the ſecond ſon of Sir Richard. He was born in the year 1537, educated in Scotland, and was afterwards ſent to France to ſtudy the law. On his return to his native country, he commenced advocate; in which profeſſion his abilities became eminently conſpicuous. In 1567, his father reſigned the privy-ſeal in his favour. This office he kept till 1570: when, for his loyalty to the queen he loſt the ſeal, and it was given to George Buchanan. He was made a ſenator of the college of juſtice, or lord of ſeſſion, in 1581; ſecretary of ſtate in 1584; and lord high chancellor in 1586. The chancellor's power and influence created him many enemies among the Scottiſh nobility, who made ſeveral attempts to deſtroy him, but without ſucceſs. In 1589, he attended the king on his voyage to Norway, where his bride, the princeſs of Denmark, was detained by contrary wind. The marriage was immediately conſummated; and they returned with the queen to Copenhagen, where they ſpent the enſuing winter. During their reſidence in Denmark, the chancellor became intimately acquainted with the celebrated Tycho-Brahe. In 1590 he was created Lord Maitland of Thirlſtane.—Towards the end of the year 1592, the chancellor incurred the queen's diſpleaſure for refuſing to relinquiſh his lordſhip of Muſſelburgh, which ſhe claimed as being a part of Dunfermline. He abſented himſelf for ſome time from court, but was at length reſtored to favour, and died of a lingering illneſs in the year 1595, much regretted by the king. He bears a high character both for talents and integrity among all hiſtorians. Melville, who writes the *Memoirs*, Mr Pinkerton obſerves, was his perſonal enemy, ſo muſt not receive much credit in his cenſures of him. Beſide his Scottiſh poetry in the *Maitland Collection*, he wrote ſeveral Latin epigrams, &c. to be found in the *Deliciæ Poetarum Scotorum*, vol. ii. The chancellor's only ſon, John Lord Thirlſtane, was firſt made viſcount and then earl of Lauderdale, by James VI. 1624. The earl's ſon was John, the only duke of Lauderdale, and born 1616 at Lethington.

MAITTAIRE (Michael), an eminently learned writer, was born in 1668. Dr South, canon of Chriſt-Church, made him a ſtudent of that houſe, where he took the degree of M. A. March 23. 1696. From 1695 till 1699 he was ſecond maſter of Weſtminſter ſchool; which was afterwards indebted to him for *Græcæ Linguæ Dialecti, in uſum Scholæ Weſtmonaſterienſis*, 1706, 8vo; and for "The Engliſh Grammar, applied to, and exemplified in, the Engliſh tongue, 1712," 8vo. In 1711, he publiſhed "Remarks on Mr Whiſton's Account of the Convocation's proceedings with relation to himſelf, in a Letter to the right reverend Father in God George Lord Biſhop of Bath and Wells," 8vo.; alſo "An Eſſay againſt Arianiſm, and ſome other Hereſies; or a Reply to Mr William Whiſton's Hiſtorical Preface and Appendix to his Primitive Chriſtianity revived," 8vo. In 1709 he gave the firſt ſpecimen of his great ſkill in typographical antiquities, by publiſhing *Stephanorum Hiſtoria, vitas ipſorum ac libros complectens*, 8vo.; which was followed in 1717 by *Hiſtoria Typographorum aliquot Pariſienſium, vitas et libras complectens*, 8vo. *In* 1719, *Annales Typographici ab artis inventæ origine ad annum* MD, 4to. The ſecond volume, divided into two parts, and continued to the year 1536, was publiſhed at the Hague in 1702; introduced by a letter of John Toland, under the title of *Conjectura veriſimilis de prima Typographiæ Inventione*. The third volume, from the ſame preſs in two parts, continued to 1557, and (by an Appendix) to 1664, in 1725. In 1733 was publiſhed at Amſterdam what is uſually conſidered as the fourth volume, under the title of *Annales Typographici ab artis inventæ origine, ad annum* MDCLXIV, *opera Mich. Maittaire, A. M. Editio nova auctior et emendatior, tomi primi pars poſteriori* (A). In 1741 the work was cloſed at London, by *Annalium Typographicorum Tomus quintus et ultimus, indicem in tomos quatuor præeuntes complectens*; divided, like the two preceding volumes, into two parts. In the intermediate years, Mr Maittaire was diligently employed on various works of value. In 1713 he publiſhed by ſubſcription *Opera et Fragmenta Veterum Poëtarum*, 1713 2 vols in folio: the title of ſome copies is dated 1721. In 1714, he was the editor of a Greek Teſtament, in 2 vols. The Latin writers, which he publiſhed ſeparately, moſt of them with good indexes, came out in the following order: In 1713, *Chriſtus Patiens*; *Juſtin*; *Lucretius*; *Phædrus*; *Salluſt*; *Terence*. In 1715, *Catullus*; *Tibullus*; *Propertius*; *Cornelius Nepos*; *Florus*; *Horace*; *Juvenal*; *Ovid*, 3 vols; *Virgil*. In 1711, *Cæſar's Commentaries*; *Martial*; *Quintus Curtius*. In 1718, and 1725, *Velleius Paterculus*. In 1719, *Lucan*. In 1720, *Bonefonii Carmina*. In 1711 he publiſhed, *Batrachomyomachia Græce ad veterum exemplarium fidem recenſa: Gloſſa Græca; variantibus lectionibus, verſionibus Latinis, commentariis et indicibus illuſtrata*, 8vo. In 1722, *Miſcellanea Græcorum aliquot Scriptorum Carmina, cum verſione Latina et Notis*, 4to. In 1784 he compiled, at the requeſt of Dr John Friend (at whoſe expence it was printed), an index to the works of *Aretæus*, to accompany the ſplendid folio edition of that author in 1723. In 1725 he publiſhed an excellent edition of *Anacreon* in 4to, of which no more than 100 copies were printed, and the few errata in each copy corrected by his own hand. A ſecond edition of the like number was printed in 1741, with ſix copies on fine writing paper. In 1726 he publiſhed *Petri Petiti Medici Pariſienſis in tres priores Aretæi Cappadocis Libros Commentarii, nunc primum editi*, 4to. This learned commentary was found among the papers of Grævius. From 1728 to 1733 he was employed in publiſhing *Marmorum, Arundelianorum, Seldenianorum, aliorumque Academiæ Oxonienſi donatorum, una cum Commentariis et Indice, editio ſecunda*, folio; to which an Appendix was printed in 1733. *Epiſtola de Mich. Maittaire ad D. P. Des Maizeaux, in qua Indicis in Annales Typographicos methodus explicatur*, &c. is printed in "The Preſent State of the Republic of Letters," Auguſt 1733, p. 142. The life of Robert Stephens in Latin, reviſed and corrected by the author, with a new and complete liſt of his works, is prefixed to the improved edition of R. Stephens's Theſaurus, 4 vols. in folio, in 1734. In 1736 appeared *Antiquæ Inſcriptiones duæ*, folio; being a commentary on two large copper tables, diſcovered near Heraclea, in the Bay of Tarentum. In 1738 were printed at the Hague *Græcæ Linguæ Dialecti in Scholæ Regiæ Weſtmonaſterienſis uſum recogniti opera Mich. Maittaire*. In 1739 he addreſſed to the empreſs of Ruſſia a ſmall Latin poem, under the title of *Carmen Epinicium Auguſtiſſimæ Ruſſorum Imperatrici ſacrum*. His name not having been printed in the title-page,

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(A) The aukwardneſs of this title has induced many collectors to diſpoſe of their firſt volume, as thinking it ſuperſeded by the ſecond edition: but this is by no means the caſe; the volume of 1719 being equally neceſſary to complete the ſet, as that of 1733, which is a reviſion of all the former volumes. The whole work, when properly bound, conſiſts, *ad libitum*, either of five volumes or of nine.

it is not ſo generally known that he was editor of Plutarch's *Apophthegmata*, 1741, 4to. The laſt publication of Mr Maittaire was a volume of poems in 4to, 1742, under the title of *Senilia, ſive Poetica aliquot in argumentis varii generis tentamina.* Mr Maittaire died in 1747, aged 79. His valuable library, which had been 50 years collecting, was ſold by auction by Meſſrs Cock and Langford, at the cloſe of the ſame year, and the beginning of the following, taking up in all 44 nights. Mr Maittaire, it may be added, was patroniſed by the firſt earl of Oxford, both before and after that gentleman's elevation to the peerage, and continued a favourite with his ſon the ſecond earl. He was alſo Latin tutor to Mr Stanhope, the earl of Cheſterfield's favourite ſon.

MAIZE, or *INDIAN Corn*. See ZEA.

MAKI. See LEMUR.

MALABAR, the name given to a great part of the weſt coaſt of the peninſula, on this ſide of the Ganges, from the kingdom of Baglala to Cape Comorin, or only from the north extremity of the kingdom of Canara as far as Cape Comorin. It is bounded by the mountains of Balligate on the eaſt; by Decan on the north; and on the weſt and ſouth is waſhed by the Indian ſea.

MALACA (anc. geog.), ſurnamed *Fæderatorum* by Pliny; a maritime town of Bæotica: A Carthaginian colony according to Strabo; ſo called from *Malach*, ſignifying "ſalt;" a place noted for pickled or ſalted meat. Now *Malaga*, a port town of Granada in Spain. W. Long. 4. 45. N. Lat. 36. 40.

MALACCA, the moſt ſoutherly part of the great peninſula beyond the Ganges, is about 600 miles in length, and contains a kingdom of the ſame name. It is bounded by the kingdom of Siam on the north; by the bay of Siam and the Indian ocean on the eaſt; and by the ſtraits of Malacca, which ſeparate it from the iſland of Sumatra, on the ſouth-weſt. This country is more to the ſouth than any other in the Eaſt Indies; and comprehends the towns and kingdoms of Patan, Pahan, Igohor, Pera, Queda, Borkelon, Ligor; and to the north the town and kingdom of Tanaſſery, where the Portugueſe formerly carried on a great trade. This laſt either does or did belong to the king of Siam. The people of Malacca are in general ſubject to the Dutch, who poſſeſs all the ſtrong places on the coaſt, and compel them to trade on their own terms, excluding all other nations of Europe from having any commerce with the natives.

The Malays are governed by feudal laws. A chief, who has the title of *king* or *ſultan*, iſſues his commands to his great vaſſals, who have other vaſſals in ſubjection to them in a ſimilar manner. A ſmall part of the nation live independent, under the title of *oranicai* or *noble*, and ſell their ſervices to thoſe who pay them beſt; while the body of the nation is compoſed of ſlaves, and in perpetual ſervitude.

The generality of theſe people are reſtleſs, fond of navigation, war, plunder, emigrations, colonies, deſperate enterpriſes, adventures, and gallantry. They talk inceſſantly of their honour and their bravery; whilſt they are univerſally conſidered by thoſe with whom they have intercourſe, as the moſt treacherous, ferocious people on earth. This ferocity, which the Malays qualify under the name of *courage*, is ſo well known to the European companies who have ſettlements in the Indies, that they have univerſally agreed in prohibiting the captains of their ſhips who may put into the Malay iſlands, from taking on board any ſeamen from that nation, except in the greateſt diſtreſs, and then on no account to exceed two or three. It is not in the leaſt uncommon for an handful of theſe horrid ſavages ſuddenly to embark, attack a veſſel by ſurpriſe, maſſacre the people, and make themſelves maſter of her. Malay batteaux, with 24 or 30 men, have been known to board European ſhips of 30 or 40 guns, in order to take poſſeſſion of them, and murder with their poignards great part of the crew. Thoſe who are not ſlaves go always armed: they would think themſelves diſgraced if they went abroad without their poignards, which they call *crit*. As their lives are a perpetual round of agitation and tumult, they cannot endure the long flowing garments in uſe among the other Aſiatics. Their habits are exactly adapted to their ſhapes, and loaded with a multitude of buttons, which faſten them cloſe to their bodies.

The country poſſeſſed by the Malays is in general very fertile. It abounds with odoriferous woods, ſuch as the aloes, the ſandal, and the Caſſia. The ground is covered with flowers of the greateſt fragrance, of which there is a perpetual ſucceſſion throughout the year. There are abundance of mines of the moſt precious metals ſaid to be richer even than thoſe of Brazil, or Peru, and in ſome places are mines of diamonds. The ſea alſo abounds with excellent fiſh, together with ambergris, pearls, and thoſe delicate bird-neſts ſo much in requeſt in China, formed in the rocks with the ſpawn of fiſhes and the foam of the ſea, by a ſpecies of ſmall-ſized ſwallow peculiar to thoſe ſeas. Theſe are of ſuch an exquiſite flavour, that the Chineſe for a long time purchaſed them for their weight in gold, and ſtill buy them at an exceſſive price. See *BIRDS-Neſt*

Notwithſtanding all this plenty, however, the Malays are miſerable. The culture of the lands, abandoned to ſlaves, is fallen into contempt. Theſe wretched labourers, dragged inceſſantly from their ruſtic employments by their reſtleſs maſters, who delight in war and maritime enterpriſes, have never time or reſolution to give the neceſſary attention to the labouring of their grounds; of conſequence the lands for the moſt part are uncultivated, and produce no kind of grain for the ſubſiſtence of the inhabitants. The ſago tree indeed ſupplies in part the defect of grain. It is a ſpecies of the palm-tree, which grows naturally in the woods to the height of about 20 or 30 feet; its circumference being ſometimes from five to ſix. Its ligneous bark is about an inch in thickneſs, and covers a multitude of long fibres, which being interwoven one with another envelope a maſs of a gummy kind of meal. As ſoon as this tree is ripe, a whitiſh duſt, which tranſpires through the pores of the leaves, and adheres to their extremities, indicates that the trees are in a ſtate of maturity. The Malays then cut them down near the root, divide them into ſeveral ſections, which they ſplit into quarters: they then ſcoop out the maſs of mealy ſubſtance, which is enveloped by and adheres to the fibres; they dilute it in pure water, and then paſs it through a ſtraining bag of fine cloth, in order to ſeparate it from the fibres. When this paſte has loſt

part

parts of its moiſture by evaporation, the Malays throw it into a kind of earthen veſſel of different ſhapes, where they allow it to dry and harden. The paſte is wholeſome nouriſhing food, and preſerves for many years.

Malacca, the capital of the country of the ſame name, is ſituated in a flat country cloſe to the ſea. The walls and fortifications are founded on a ſolid rock, and are carried up to a great height; the lower part of them is waſhed by the ſea at every tide, and on the land-ſide is a wide canal or ditch, cut from the ſea to the river, which makes it an iſland. In 1641 it was taken from the Portugueſe by the Dutch, ſince which time it has continued in their poſſeſſion. In this city there are a great many broad ſtreets; but they are very badly paved. The houſes are tolerably well built, and ſome of them have gardens behind or on one ſide. The inhabitants conſiſt of a few Dutch, many Malayans, Moors, Chineſe, and other Indians, who are kept in awe by a fortreſs, which is ſeparated from the city by a river, and by good walls and baſtions, as well as by ſtrong gates, and a draw-bridge that is on the eaſtern ſide. The city is well ſituated for trade and navigation. E. Long. 102. 2. N. Lat. 2. 12.

MALACHI, or the prophecy of Malachi, a canonical book of the Old Teſtament, and the laſt of the 12 leſſer prophets. Malachi propheſied about 300 years before Chriſt, reproving the Jews for their wickedneſs after their return from Babylon, charging them with rebellion, ſacrilege, adultery, profaneneſs, and infidelity; and condemning the prieſts for being ſcandalouſly careleſs in their miniſtry: at the ſame time not forgetting to encourage the pious few, who, in that corrupt age, maintained their integrity. This prophet diſtinctly points at the Meſſiah, who was ſuddenly to come to his temple, and to be introduced by Elijah the prophet, that is, by John the Baptiſt, who came in the ſpirit and power of Elias, or Elijah.

MALACIA, in medicine, is a languiſhing diſorder incident to pregnant women, in which they long ſometimes for one kind of food and ſometimes for another, and eat it with extraordinary greedineſs.

MALACOPTERYGEOUS, among ichthyologiſts, an appellation given to ſuch fiſhes as have the rays of their fins bony, but not pointed or ſharp at the extremities like thoſe of ancanthopterygeous fiſhes.

MALACOSTOMOUS fishes, thoſe deſtitute of teeth in the jaws, called in Engliſh *leather-mouthed*, as the tench, carp, bream, &c.

MALAGA, an ancient, rich, and ſtrong town of Spain, in the kingdom of Grenada, with two caſtles, a biſhop's ſee, and a good harbour, which renders it a place of conſiderable commerce. The advantage of this commerce, according to M. Bourgoanne, is entirely in favour of Spain, but almoſt without any to its navigation; of 842 veſſels which arrived at this port in 1782, from almoſt every commercial nation, ſcarcely 100 were Spaniſh, even reckoning the ſhips of war which anchored there. The Engliſh, who are in poſſeſſion of the greateſt part of the trade, carry thither woollens and great quantities of ſmall ware; the Dutch carry ſpice, cutlery ware, laces, ribbons, thread, &c. Theſe nations, thoſe of the north, and Italy, export to the amount of two millions and a half of piaſtres in wines, fruits, ſumach, pickled anchovies, oil, &c. and all they carry thither amounts only to above a million and a half. The balance would be ſtill more advantageous for Malaga if the ſilk and wool of the kingdom of Grenada were exported from this port; but theſe are employed in the country where they are produced. The ſtreets of Malaga are narrow, but there are ſome good ſquares; and the cathedral church is a ſuperb building, ſaid to be as large as St Paul's. The only other building of note is the biſhop's palace; which is a large edifice, but looks inſignificant from its being ſituated near the other. Its prelate enjoys a revenue of L. 16,000 Sterling. Malaga is ſeated on the Mediterranean ſea, at the foot of a craggy mountain. E. Long. 4. 56. N. Lat. 6. 51.

MALAGRIDA (Gabriel), an Italian Jeſuit, was choſen by the general of the order to conduct miſſions into Portugal. To great eaſe and fluency of ſpeech, for which he was indebted to enthuſiaſm, he added the moſt ardent zeal for the intereſt of the ſociety to which he belonged. He ſoon became the faſhionable director; and every one, ſmall or great, placed himſelf under his conduct. He was reſpected as a ſaint, and conſulted as an oracle. When a conſpiracy was formed by the duke d'Aveiro againſt the king of Portugal, it is aſſerted by the enemies of the ſociety, that three Jeſuits, among whom was Malagrida, were conſulted concerning the meaſure. They add (what is very improbable), that it was decided by theſe caſuiſts, that it was only a venial crime to kill a king who perſecuted the ſaints. At that time the king of Portugal, ſpurred on by a miniſter who had no favour for the Jeſuits, openly declared himſelf againſt them, and ſoon after baniſhed them from his kingdom. Only three of them were apprehended, Malagrida, Alexander, and Mathos, who were accuſed of having approved his murder. But either the trial could not be proceeded in without the conſent of the pope, which was not granted, or no proof could be got ſufficient to condemn Malagrida; and therefore the king was obliged to deliver him to the inquiſition, as being ſuſpected of having formerly advanced ſome raſh propoſitions which bordered on hereſy. Two publications which he acknowledged, and which give the fulleſt indications of complete inſanity, were the foundation of theſe ſuſpicions. The one was written in Latin, and intitled *Tractatus de vita et imperio Antichriſti*; the other in Portugueſe, under the title of the "Life of St Anne, compoſed with the aſſiſtance of the bleſſed Virgin Mary and her moſt holy Son." They are full of extravagance and abſurdity.—This enthuſiaſt pretended to have the gift of miracles. He confeſſed before the judges of the Inquiſition, that God himſelf had declared him his ambaſſador, apoſtle, and prophet; that he was united to God by a perpetual union; and that the Virgin Mary, with the conſent of Jeſus Chriſt and of the whole Trinity, had declared him to be her ſon. In ſhort, he confeſſed, as is pretended, that he felt in the priſon, at the age of 72, ſome emotions very uncommon at that period of life, which at firſt gave him great uneaſineſs, but that it had been revealed to him by God that theſe emotions were only the natural effect of an involuntary agitation, wherein there was the ſame merit as in prayer. It was for ſuch extravagancies that this unfortunate wretch was condemned by the Inquiſition ; but his death was haſtened by a viſion which he eagerly revealed. Upon occaſion of the death of the marquis de Tancourt, commander in chief of the province of Eſtremadura, mournful and continued diſcharges were made in honour of him by the caſtle of Liſbon, and by all the forts on the banks of the Tagus. Theſe being heard by Malagrida in his dungeon, he inſtantly ſuppoſed, from their extraordinary nature, and from their happening during the night, that the king was dead. The next day he demanded an audience from the members of the Inquiſition : which being granted, he told them that he had been ordered by God to ſhow the miniſter of the holy office that he was not a hypocrite, as was pretended ; for the king's death had been revealed to him, and he had ſeen in a viſion the torments to which his majeſty was condemned for having perſecuted the religious of his order. This was ſufficient to accelerate his puniſhment : he was burnt on the 21ſt of September 1761 ; not as the accomplice of a parricide, but as a falſe prophet, for which he deſerved to be confined in bedlam rather than tied to the ſtake. The acts of impiety whereof he was accuſed were nothing more than extravagancies proceeding from a miſtaken devotion and an overheated brain.

MALDEN, a town of Eſſex, 37 miles from London, ſituated on an eminence at the conflux of the Chelmer and Pant or Black-water, where they enter the ſea. It was the firſt Roman colony in Britain, and the ſeat of of the old Britiſh kings. It was beſieged, plundered, and burnt by queen Boadicea ; but the Romans repaired it. It was again ruined by the Danes, but rebuilt by the Saxons. It is a populous corporation, governed by two bailiffs, ſix aldermen, 18 headboroughs or capital burgeſſes, a ſteward, recorder, and above 400 commonalty and burgeſſes, who have all a vote for its members of parliament. It has a convenient haven on an arm of the ſea for veſſels of 400 tons ; and drives a good trade in coal, iron, corn, and deals. It formerly had three, now only two, pariſh-churches. Here is a large library for the uſe of the miniſter and the clergy of the neighbouring pariſhes, who generally reſide here on account of the unwholeſomeneſs of the air where their churches are. Here is a grammar-ſchool, a ſmall-church, ſchool, and a workhouſe where the poor weave ſack cloth. The cuſtom of Borough Engliſh is kept up here. It has a market on Saturdays, and a fair on the 18th of September. A little beyond it begins Blackwater-bay, famous for the Walfleet oyſters. The channel called Malden-water is navigable to the town. King Edward the elder (of the Saxon race) reſided here whilſt he built Witham and Hertford caſtles. On the weſt ſide of the town are the remains of a camp.

MALALEUCA, the CAYPUTI TREE : A genus of the polyandria order, belonging to the polyadelphia claſs of plants. There is but one ſpecies, viz. the leucodendrum, a native of the Eaſt Indies and South-Sea iſlands Mr Forſter relates that lencodendra were found in the iſland of New Caledonia : they were black at the root ; but had a bark perfectly white and looſe, with long narrow leaves like our willows. The leaves are extremely fragrant and aromatic ; and Rumphius tells us, that from them the natives of the Moluccas make the oil called *cayputi*. The oil is commended as a nervous medicine, and as being uſeful in ſome cardialgies. The doſe is four or five drops in ſome convenient liquor.

MALDIVIA ISLANDS, a cluſter of ſmall iſlands in the Indian ocean, 500 miles ſouth-weſt of the continent of the iſland of Ceylon. They are about 1000 in number, and are very ſmall; extending from the ſecond degree of ſouth latitude to the ſeventh degree north latitude. They are generally black low lands. ſurrounded by rocks and ſands. The natives are of the ſame complexion with the Arabians, profeſs the Mahometan religion, and are ſubject to one ſovereign. The channels between the iſlands are very narrow, and ſome of them are fordable. They produce neither rice, corn, nor herbage ; but the natives live upon cocoa-nuts and other fruits, roots, and fiſh. They have little or nothing to barter with, unleſs the ſhells called *cowrys*, or *blackmore's teeth*, with which they abound; and theſe ſerve inſtead of ſmall coin in many parts of India.

MALDONAT (John), a Spaniſh Jeſuit born in 1534, was accuſed of hereſy, and of procuring a fraudulent will in ſeducing the preſident de St Andre at Paris to bequeath his eſtate to the Jeſuits. Peter Gondi acquitted him of the firſt charge, and the parliament of Paris of the other. He retired after theſe troubles to Bourges, but went to Rome by order of pope Gregory XIII. to take care of the publication of the Septuagint; and there, finiſhing his commentary on the goſpels in 1582, he died in the beginning of the following year. He wrote, beſides, Commentaries on Jeremiah, Baruch, Ezekiel, and Daniel : a treatiſe on the ſacraments, on grace, on original ſin ; and ſeveral other pieces printed at Paris in 1677, in folio. His ſtyle is clear, lively, and eaſy. He does not ſervilely follow the ſcholaſtic divines; but is pretty free, and ſometimes ſingular in his ſentiments.

MALE, among zoologiſts, that ſex of animals which has the parts of generation ſituated externally. See SEX and GENERATION.

The term *male* has alſo, from ſome ſimilitude to that ſex in animals, been applied to ſeveral inanimate things; thus we ſay a male flower, a male ſcrew, &c. See MAS *Planta*, MASCULUS *Flos*, and SCREW : alſo FEMALE and FLOS.

MALEBRANCHE (Nicholas), an eminent French metaphyſician, the ſon of Nicholas Malebranche, ſecretary to the French king, was born in 1638, and admitted into the congregation of the oratory in 1660. He at firſt applied himſelf to the ſtudy of languages and hiſtory: but afterwards meeting with Des Cartes's *Treatiſe on Man*, he gave himſelf up entirely to the ſtudy of philoſophy. In 1699, he was admitted an honorary member of the Royal Academy of Sciences at Paris. Notwithſtanding he was of a delicate conſtitution, he enjoyed a pretty good ſtate of health till his death, which happened in 1715, at the age of 77. Father Malebranche read little, but thought a great deal. He deſpiſed that kind of philoſophy which conſiſts only in knowing the opinions of other men, ſince a perſon may know the hiſtory of other mens thoughts without thinking himſelf. He could never read ten verſes together without diſguſt. He meditated with his windows ſhut, in order to keep out the light, which he found to be a diſturbance to him. His converſation turned upon the ſame ſubjects as his books; but was mixed with ſo much modeſty and deference to the judgment of others, that it was extremely and univerſally deſired. His books are famous: particularly his *Recherche de la Verite*, i. e. "Search after truth;" his deſign in which is, to point to us the errors in which we are daily led by our ſenſes, imagination and paſſions; and to preſcribe a method for diſcovering the truth, which he does, by ſtarting the notion of ſeeing all things in God. And hence he is led to think and ſpeak merely of human knowledge, either as it lies in written books, or in the book of nature, compared with that light which diſplays itſelf from the ideal world; and by attending to which, with pure and defecate minds, he ſuppoſes knowledge to be moſt eaſily had. The fineneſs of this author's ſentiments, together with his fine manner of expreſſing them, made every body admire his genius and abilities; but he has generally paſſed for a viſionary philoſopher. Mr Locke, in his examination of Malebranche's opinion of ſeeing all things in God, ſtyles him "an accute and ingenious author;" and tells us, that there are "a great many very fine thoughts, judicious reaſonings, and uncommon reflections, in his *Recherche*." But Mr Locke, in that piece, endeavours to refute the chief principles of his ſyſtem. He wrote many other pieces beſides that we have mentioned, all tending ſome way or other to confirm his main ſyſtem, eſtabliſhed in the *Recherche*, and to clear it from the objections which were brought againſt it, or from the conſequences which were deduced from it: and if he has not attained what he aimed at in theſe ſeveral productions, he has certainly ſhown great abilities and a vaſt force of genius.

MALHERBE (Francis de), the beſt French poet of his time, was born at Caen about the year 1556, of a noble and ancient family. He quitted Normandy at 17 years of age; and went into Provence; where he attached himſelf to the family of Henry Angouleme, the natural ſon of king Henry II, and was in the ſervice of that prince till he was killed by Altoviti in 1587. At length cardinal de Perron, being informed of his merit and abilities, introduced him to Hen. IV. who took him into his ſervice. After that monarch's death, queen Mary de Medicis ſettled a penſion of 500 crowns upon our poet, who died at Paris in 1628. The beſt and moſt complete edition of his poetical works is that of 1666, with Menage's remarks. Malherbe ſo far excelled all the French poets who preceded him, that Boileau conſiders him as the father of French poetry: but he compoſed with great difficulty, and put his mind on the rack in correcting what he wrote. He was a man of a ſingular humour, blunt in his behaviour, and without religion. When the poor uſed to promiſe him, that they would pray to God for him, he anſwered them, that "he did not believe they could have any great intereſt in heaven, ſince they were left in ſuch a bad condition upon earth; and that he would be better pleaſed if the duke de Luyne, or ſome other favourite, had made him the ſame promiſe.' He would often ſay that "the religion of gentlemen was that of their prince." During his laſt ſickneſs he had much ado to reſolve to confeſs to a prieſt; for which he gave this facetious "reaſon that he never uſed to confeſs but at Eaſter." And ſome few moments before his death, when he had been in a lethargy two hours, he awaked on a ſudden to remove his landlady, who waited on him, for uſing a word that was not good French; ſaying to his confeſſor, who reprimanded him for it, that "he could not help it, and he would defend the purity of the French language to the laſt moment of his life.'

MALICE, in ethics and law, is a formed deſign of doing miſchief to another; it differs from hatred. In murder, it is malice makes the crime; and if a man, having a malicious intent to kill another, in the execution of his malice kills a perſon not intended, the malice ſhall be connected to his perſon, and he ſhall be adjudged a murderer. The words *ex malitia præcogitata* are neceſſary to an indictment of murder, And this *malitia præcogitata*, or malice *prepenſe*, may be either expreſs or implied in law, Expreſs malice is, when one, with a ſedate, deliberate mind and formed deſign, kills another; which formed deſign is evidenced by external circumſtances diſcovering that intention; as lying in wait, antecedent menaces, former grudges, and concerted ſchemes to do him ſome bodily harm. Beſides, where no malice is expreſſed, the law will imply it; as where a man wilfully poiſons another, in ſuch a deliberate act the law preſumes malice, though no particular enmity can be proved. And if a man kills another ſuddenly, without any or without a conſiderable provocation, the law implies malice; for no perſon, unleſs of an abandoned heart, would be guilty of ſuch an act upon a ſlight or no apparent cauſe.

MALIGNANT, among phyſicians, a term applied to diſeaſes of a very dangerous nature, and generally infectious; ſuch are the dyſentery, hoſpital-fever, &c. in their worſt ſtages.

Malignity among phyſicians ſignifies much the ſame with contagion. See CONTAGION.

MALL, SEA-MALL, or *ſea-mew*, in ornithology. See LARUS.

MALLARD, in ornithology. See ANAS.

MALLEABLE, a property of metals whereby they are capable of being extended under the hammer.

MALLENDERS, in farriery. See there § xxxiv.

MALLEOLI, in the ancient art of war, were bundles of combuſtible materials, ſet on fire to give light in the night, or to annoy the enemy; when they were employed for the latter purpoſe they were ſhot out of a bow, or fixed to a javelin, and thus thrown into the enemies engines, ſhips, &c. in order to burn them. Pitch was always a principal ingredient in the compoſition. The malleoli had alſo the name of *pyroboli*.

MALLET or MALLOCH, (David) an Engliſh poet, but a Scotſman by birth, was born in that country about 1700. By the penury of his parents he was compelled to be janitor of the high ſchool at Edinburgh; but he ſurmounted the diſadvantages of his birth and fortune; for when the Duke of Montroſe applied to the college of Edinburgh for a tutor to educate his ſons, Malloch was recommended. When his pupils went abroad, they were intruſted to his care; and having conducted them through their travels, he returned with them to London. Here, reſiding in their family, he naturally gained admiſſion to perſons of high rank and character, and began to give ſpecimens of his poetical talents. In 1733, he publiſhed a poem on Verbal Criticiſm, on purpoſe to make his court to Pope. In 1740, he wrote a Life of Lord Bacon, which was then prefixed to an edition of his works; but with ſo much more knowledge of hiſtory than of ſcience, that, when he afterwards undertook the Life of Marlborough, ſome were apprehenſive leſt he ſhould forget that Marlborough was a general, as he had forgotten that Bacon was a philoſopher. The old ducheſs of Marlborough aſſigned in her will this taſk to Glover and Mallet, with a reward of 1000 l. and a prohibition to inſert any verſes. Glover is ſuppoſed to have rejected the legacy with diſdain, ſo that the work devolved upon Mallet; who had alſo a penſion from the late duke of Marlborough to promote his induſtry, and who was continually talking of the diſcoveries he made, but left not when he died any hiſtorical labours behind him. When the prince of Wales was driven from the palace, and kept a ſeparate court by way of oppoſition, to increaſe his popularity by patronizing literature, he made Mallet his under-ſecretary, with a ſalary of 200l. a year.—Thomſon likewiſe had a penſion; and they were aſſociated in the compoſition of the Maſque of Alfred, which in its original ſtate was played at Cliefden in 1740. It was afterwards almoſt wholly changed by Mallet, and brought upon the ſtage of Drury Lane in 1751, but with no great ſucceſs. He had before publiſhed two tragedies; Eurydice, acted at Drury Lane in 1731; and Muſtapha, acted at the ſame theatre in 1739. It was dedicated to the prince his maſter, and was well received, but never was revived. His next work was Amyntor and Theodora (1747), a long ſtory in blank verſe; in which there is copiouſneſs and elegance of language, vigour of ſentiment, and imagery well adapted to take poſſeſſion of the fancy. In 1753, his maſque of Britannia was acted at Drury Lane, and his tragedy of Elvira in 1763; in which year he was appointed keeper of the book of entries for ſhips in the port of London. In the beginning of the laſt war, when the nation was exaſperated by ill ſucceſs, he was employed to turn the public vengeance upon Byng, and wrote a letter of accuſation under the character of a Plain Man. The paper was with great induſtry circulated and diſperſed; and he for his ſeaſonable intervention had a conſiderable penſion beſtowed upon him, which he retained to his death. Towards the end of his life he went with his wife to France; but after a while, finding his health declining, he returned alone to England, and died in April 1765. He was twice married, and by his firſt wife had ſeveral children. One daughter, who married an Italian of rank named Cileſia, wrote a tragedy called Almida, which was acted at Dury Lane. His ſecond wife was the daughter of a nobleman's ſteward, who had a conſiderable fortune, which ſhe took care to retain in her own hands. His ſtature was diminutive, but he was regularly formed; his appearance, till he grew corpulent, was agreeable, and he ſuffered it to want no recommendation that dreſs could give it. His converſation was elegant and eaſy.

MALLET (Edme) was born at Melun in 1713, and enjoyed a curacy in the neighbourhood of his native place till 1751, when he went to Paris to be profeſſor of theology in the college of Navarre, of which he was admitted a doctor. Boyer, the late biſhop of Mirepoix, was at firſt much prejudiced againſt him; but being afterwards undecieved, he conferred upon him the ſee of Verdun as a reward for his doctrine and morals. Janſeniſm had been imputed to him by his enemies with this prelate; and the Gazette which went by the name of *Eccleſiaſtical*, accuſed him of impiety. Either of theſe imputations was equally undeſerved by the Abbé Mallet: as a Chriſtian, he was grieved at the diſputes of the French Church; and, as a philoſopher, he was aſtoniſhed that the government had not, from the very beginning of thoſe diſſenſions impoſed ſilence on both parties. He died at Paris in 1755, at the age of 42. The principal of his works are, 1. *Principes pour la lecture des Poëtes*, 1745, 12mo. 2 vols. 2. *Eſſai ſur l'Etude des Belles-Lettres*, 1747, 12mo. 3. *Eſſai ſur les bienſeances oratoires*, 1753, 12mo. 4. *Principes pour la lecture des Orateurs*, 1753, 12mo, 3 vols. 5. *Hiſtoire des Guerres civiles de France ſous les regnes de François II. Charles IX. Henri III. & Henry IV.* tranſlated from the Italian of d'Avila.—In Mallet's works on the poets, Orators, and the Belles Lettres, his object is no more than to explain with accuracy and preciſion the rules of the great maſters, and to ſupport them by examples from authors ancient and modern. The ſtyle of his different writings, to which his mind bore a great reſemblance, was neat, eaſy, and unaffected. But what muſt render his memory eſtimable, was his attachment to his friends, his candour, moderation, gentleneſs, and modeſty. He was employed to write the theological and belles-lettres articles in the *Encyclopêdie*; and whatever he wrote in that dictionary was in general well compoſed. Abbé Mallet was preparing two important works when the world was deprived of him by death. The firſt was *Une Hiſtoire generale de nos Guerres depuis le commencement de la Monarchie*; the ſecond, *Une Hiſtoire du Concile de Trente*, which he intended to ſet in oppoſition to that of Father Paul tranſlated by Eather le Courayer.

MALLET, a large kind of hammer made of wood; much uſed by artificers who work with a chiſſel, as ſculptors, maſons, and ſtone-cutters, whoſe mallet is ordinarily round; and by carpenters, joiners, &c. who uſe it ſquare. There are ſeveral ſorts of mallets uſed for different purpoſes on ſhip-board. The calking mallet is chiefly employed to drive the oakum into the ſeams of a ſhip, where the edges of the planks are joined to each other in the ſides, deck, or bottom. The head of this mallet is long and cylindrical, being hooped with iron to prevent it from ſplitting in the exerciſe of calking. There is alſo the ſerving mallet, uſed in ſerving the rigging, by binding the ſpun-yarn more firmly about it than could poſſibly be done by hand, which is performed in the following manner: the ſpun-yarn being previouſly rolled up in a large ball or clue, two or three turns of it are paſſed about the rope, and about the body of the mallet, which for this purpoſe is finiſhed with a round channel in its ſurface, that conforms to the convexity of the rope intended to be ſerved. The turns of the ſpun-yarn being ſtrained round the mallet, ſo as to confine it firmly to the rope, which is extended above the deck, one man paſſes the ball continually about the rope, whilſt the other, at the ſame time, winds on the ſpun-yarn by means of the mallet, whoſe handle acting as a lever ſtrains every turn about the rope as firm as poſſible.

MALLEVILLE (Claud de), a French poet, born at Paris, was one of the firſt members of the French academy, and gained a prize from Voiture and other ingenious men. He became ſecretary to M. de Baſſompierre, to whom he performed important ſervices while he was in priſon; and with the rewards he received for them he purchaſed the place of ſecretary to the king. He was likewiſe ſecretary to the French academy, and died in 1647. He wrote ſonnets, ſtanzas, elegies, epigrams, ſongs, madrigals, and a paraphraſe on ſome of the Pſalms. His ſonnets are moſt eſteemed.

MALLICOLLO, one of the new Hebrides iſlands in the ſouth-ſea, and the moſt conſiderable of them all next to *Eſpiritu Santo*. It is 18 leagues long from ſouth-eaſt to north-weſt; its greateſt breadth, which is at the ſouth-eaſt end, is eight leagues; the north-weſt end is two-thirds its breadth, and narrower in the middle one-third. This contraction is occaſioned by a wide and deep bay on the ſouth-weſt ſide. It appears to be very fertile, and well inhabited; the land on the ſea coaſt is rather low, and lies with a greater ſlope from the hills which are in the middle of the iſland; lat. 16 deg. 28. min. ſouth; 167 deg. 56 min. eaſt. On inquiring of the natives the name of this iſland, they were anſwered that it was Mallicollo, which has a near reſemblance to Manicolo, the name which Quiros received for it 160 years before. He did not indeed viſit the iſland, but had his intelligence from the natives.

The ſouth coaſt, which was moſt attentively examined by captain Cook, is luxuriantly clothed with wood and other vegetables, from the ſea-ſhore to the very ſummits of the hills. To the north-weſt, the country is leſs woody, but more agreeably interſected by lawns, ſome of which appeared to be cultivated. The vegetable productions of this country ſeemed to be in great variety; cocoa nuts, bread-fruit, bananas, ſugar-canes, yams, eddoes, and turmeric: but captain Cook thought the fruits here not ſo good as at the Society and Friendly Iſles. Hogs, and common poultry, are the domeſtic animals; and as the frequent ſqueaking of pigs was heard in the woods, it was concluded that the former are in conſiderable numbers here. A brace of Taheitian puppies was given them, with a view to ſtock the country with that ſpecies of animal: theſe they received with ſtrong ſigns of ſatisfaction. The woods appeared to be inhabited by many ſpecies of birds. Here was caught a ſhark, which meaſured nine feet in length, on which the ſhip's company feaſted with great reliſh: this ſhark, when cut open, was found to have the bony point of an arrow ſticking in its head, having been ſhot quite through the ſkull. The wound was healed ſo perfectly, that not the ſmalleſt veſtige of it appeared on the outſide: a piece of the wood ſtill remained ſticking to the bony point, as well as a few fibres with which it had been tied on; but both the wood and the fibres were ſo rotted, as to crumble into duſt at the touch. Two large reddiſh fiſh of the ſea bream kind were likewiſe caught, on which moſt of the officers and ſome of the petty officers dined the next day. The night following every one who had eaten of them was ſeized with violent pains in the head and bones, attended with a ſcorching heat all over the ſkin, and numbneſs in the joints; even ſuch hogs and dogs as had partaken of theſe fiſh gave ſtrong ſymptoms of being poiſoned: one hog, who had eaten of the garbage, ſwelled to a great ſize, and died at night: ſeveral dogs were affected in the ſame manner; they groaned moſt piteouſly, had violent reachings, and could hardly drag their limbs along. Theſe fiſh were ſuppoſed to have been of the ſame ſort with thoſe which Quiros mentions to have produced ſimilar effects on board his ſhip, and which he calls *pargos*, which is the Spaniſh name for the ſea-bream. Perhaps theſe fiſh are not always poiſonous; but, like many ſpecies in the Weſt and Eaſt Indies, may acquire that quality by feeding on poiſonous vegetables: which concluſion is ſupported by the circumſtance of the inteſtines having been found to be more poiſonous than the reſt. The effects of this poiſon on the officers continued for near a fortnight, during which time their pains returned every night, their teeth were looſe, and their gums and palate excoriated.

The natives of Mallicollo are deſcribed as the moſt ugly, ill-proportioned people imaginable, and in every reſpect different from the other iſlanders in the South-Sea: they are of a very dark colour, and diminutive ſize; with long heads, flat faces, and monkey countenances; their hair, in general, black or brown, ſhort and curly, but not quite ſo ſoft and woolly as that of a negro. Their beards are very ſtrong, criſp, and buſhy, and generally black and ſhort. But what ſerves greatly to increaſe their natural deformity is a cuſtom which they have of wearing a belt, or cord, round their waiſt: this rope is as thick as a man's finger; and is tied ſo tight round their belly, that it would be fatal to a perſon unaccuſtomed from infancy to ſuch an unnatural ligature; for it cuts ſuch a deep notch acroſs the navel, that the belly ſeems in a manner divided, one part being above and the other below the rope. The men go quite naked, except a piece of cloth or leaf uſed as a wrapper. Moſt other nations invent ſome kind of covering from motives of ſhame; but here a roll of cloth, continually faſtened to the belt, rather diſplays than conceals, and is the oppoſite of modeſty. Beſides having the flat broad noſe and projecting cheek-bones of a negro, and a very ſhort forehead, many increaſed their natural uglineſs by painting their faces and breaſts with a black colour. Some few had a ſmall cap on the head made of matted-work. They wear bracelets of white and black ſhells, which preſs the upper arm ſo cloſely, that they ſeem to have been put on when the wearer was very young: this tends, as well as the belt, to reduce the Mallicolleſe to that ſlender ſhape which characteriſes them. The depreſſion of their foreheads is ſuppoſed to be artificial, as the heads of infants may be ſqueezed into any kind of form.

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The firſt natives that were ſeen carried clubs in their hands, and waded into the water, carrying green boughs, the univerſal ſign of peace. In a day's time they ventured to come within a few yards of the ſhip's boat, which was ſent out; when they dipped their hands into the ſea, and gathering ſome water in their palms, poured it on their heads. The officers in the boat, in compliance with their example, did the ſame, with which the Indians appeared to be much pleaſed. They repeated the word *tomarr*, or *tomarro*, continually: which ſeemed to be an expreſſion among them equivalent to *tayo* among the Society iſlands. The greater part were now armed with bows and arrows, and a few with ſpears. At length they ventured near the ſhip, and received a few preſents of Taheitian cloth, which they eagerly accepted, and handed up their arrows in exchange, ſome of which were pointed with wood and ſome with bone, and daubed with a black gummy ſtuff which was ſuppoſed to be poiſoned: but its effects were tried on a dog, without producing any dangerous ſymptoms. They continued about the ſhip, talking with great vociferation, but at the ſame time in ſuch a good-humoured manner as was very entertaining. On looking ſtedfaſtly at one of them, he began to chatter with great fluency, and "grinned horribly a ghaſtly ſmile." Some continued about the ſhip till midnight; finding, however, at length, that they were but little noticed, for the captain wanted to get rid of them, they returned on ſhore, where the ſound of ſinging and beating their drums was heard all night. Mr Forſter ſuppoſes there may be 50,000 inhabitants on this extenſive iſland, which contains more than 600 ſquare miles. "We ought (ſays he) to figure to ourſelves this country as one extenſive foreſt; they have only begun to clear and plant a few inſulated ſpots, which are loſt in it like ſmall iſlands in the Pacific Ocean." Perhaps, if we could penetrate through the darkneſs which involves the hiſtory of this nation, we might find that they have arrived in the South-Sea much later than the natives of the Friendly and Society Iſlands: ſo much at leaſt is certain, that the latter appear to be a race totally diſtinct from the former; their form, their language, and their manners; ſtrongly mark this difference. The natives, on ſome parts of New-Guinea and Papua, ſeem to correſpond in many particulars, with what has been obſerved of the Mallicolleſe. They differ likewiſe very widely from the light-coloured inhabitants of the South-Sea, by keeping their bodies entirely free of punctures. Whatever theſe people ſaw they coveted; but they never repined at a refuſal. The looking-glaſſes which were given them were higly eſteemed, and they took great pleaſure in viewing themſelves; ſo that theſe ugly people ſeemed to have more conceit than the beautiful nation at O-Taheitee and the Society Iſlands. Early the next morning the natives came off to the ſhip in their canoes, and four or five of them went on board without any arms. They ſoon became familiar, and, with the greateſt eaſe, climbed up the ſhrouds to the maſthead; when they came down, the captain took them into his cabbin, and gave them medals, ribbons, nails, and pieces of red baize. They appeared the moſt intelligent of any nation that had been ſeen in the South-Sea: they readily underſtood the meaning conveyed by ſigns and geſtures; and in a few minutes taught the gentlemen of the ſhip ſeveral words in their language which appeared to be wholly diſtinct from that general language of which ſo many dialects are ſpoken at the Society-Iſlands, the Marqueſas, Friendly-Iſles, Eaſter-Iſland, and New-Zeeland. Their language was not difficult to pronounce, but contained more conſonants than any of them. Mr Forſter, and ſome of the gentlemen from the ſhip, went on ſhore, and converſed with the natives, who with great goodwill ſat down on the ſtump of a tree to teach them their language. They were ſurpriſed at the readineſs of their gueſts to remember, and ſeemed to ſpend ſome time in pondering how it was poſſible to preſerve the ſound by ſuch means as pencils and paper. They were not only aſſiduous in teaching; but had curioſity enough to learn the language of the ſtrangers, which they pronounced with ſuch accuracy as led their inſtructors to admire their extenſive faculties and quick apprehenſion. Obſerving their organs of ſpeech to be ſo flexible, they tried the moſt difficult ſounds in the European languages, and had recourſe to the compound Ruſſian *ſhtch*, all of which they pronounced at the firſt hearing without the leaſt difficulty. They preſently learned the Engliſh numerals, which they repeated rapidly on their fingers, ſo that what they wanted in perſonal beauty was amply compenſated to them in acuteneſs of underſtanding. They expreſs their admiration by hiſſing like a gooſe.

Their muſic is not remarkable either for harmony or variety, but ſeemed to be of a more lively turn than that at the Friendly-Iſlands. Their behaviour to their viſitants was, in general, harmleſs, but cautious: they gave them no invitation to ſtay amongſt them; for they ſeemed not to reliſh the proximity of ſuch powerful people, being probably accuſtomed to acts of violence and outrage from their neighbours. "In ſome of their countenances (ſays Mr Forſter), we thought we could trace a miſchievous, ill-natured diſpoſition; but we might miſtake jealouſy for hatred."

Very few women were ſeen, but theſe few were no leſs ugly than the men: they were of ſmall ſtature, and their heads, faces, and ſhoulders, were painted red. Thoſe who were grown up, and probably married, had ſhort pieces of a kind of cloth, or rather matting, round their waiſts, reaching nearly to their knees; the reſt had only a ſtring round the middle, with a wiſp of ſtraw; and the younger ones, from infancy to the age of 10 years, went ſtark naked, like the boys of the ſame age. The women were not obſerved to have any finery in their ears or round their necks and arms, it being faſhionable in this iſland for the men only to adorn themſelves; and wherever this cuſtom prevails, the other ſex is commonly oppreſſed, deſpiſed, and in a ſtate of ſervility. Here the women were ſeen with bundles on their backs, which contained their children; the men ſeemed to have no kind of regard for them. None of them came off to the ſhip, and they generally kept at a diſtance when any party landed from the boat. They perforate the cartilage of the noſe between the noſtrils, and thruſt therein a piece of white ſtone about an inch and a half long, which is bent like the curvature of a bow. The houſes here are, like thoſe of the other iſles, rather low, and covered with palm-

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thatch. Some were incloſed or walled round with boards, and the entrance to theſe was by a ſquare hole at one end.

Their weapons are bows and arrows, and a club about two feet and a half in length, made of the cauſuarina wood, commonly knobbed at one end, and well poliſhed. This weapon they hang on their right ſhoulder, from a thick rope made of a kind of graſs. It appeared to be preſerved for cloſe engagements, after having emptied the quiver. On the left wriſt they wear a circular wooden plate, neatly covered, and joined with ſtraw about five inches in diameter, upon which they break the violence of the recoiling bow-ſtring, and preſerve their arm unhurt. Their arrows are made of a ſort of reed; and are ſometimes armed with a long ſharp point made of the red-wood, and ſometimes with a very hard point made of bone: and theſe points are all covered with a ſubſtance which was ſuppoſed to be poiſoned. Indeed the people themſelves confirmed theſe ſuppoſitions, by making ſigns to the gentlemen of the ſhip not to touch the point, and giving them to underſtand that if they were pricked by them they would die; they are very careful of them themſelves, and keep them always wrapt up in a quiver. Some of theſe arrows are armed with two or three points each, with ſmall prickles on the edge to prevent the arrow from being drawn out of the wound. Repeated and effectual trials of the virulence of this poiſon were made upon dogs, but they gave no ſigns of being hurt by it.

Their food ſeems to be principally vegetables, ſince they apply themſelves to huſbandry. As hogs and fowls are bred here, the natives, doubtleſs, feaſt ſometimes on pork and poultry; and as they have canoes, it may be ſuppoſed that they draw a part of their ſubſiſtence from the ocean. The greateſt number of canoes that were ſeen along-ſide the ſhip at one time did not exceed 10, or, according to Mr Forſter, 14, and no more than four or five people in each: they were ſmall, of indifferent workmanſhip, and without ornament; but provided with an outrigger.

After ſome ſlight indications of a hoſtile intention on the part of the natives, which they had ſhown in their canoes whilſt about the ſhip, captain Cook, with a party of marines in two boats, landed in the face of 400 or 500 Indians who were aſſembled on the ſhore. Tho' they were all armed with bows and arrows, clubs and ſpears, they made not the leaſt oppoſition; on the contrary, ſeeing the captain advance alone, unarmed, with only a green branch in his hand, one of them, who ſeemed to be a chief, giving his bow and arrows to another, met him in the water, bearing alſo a green branch. When they met, the branches were exchanged and the chief led the captain by the hand up to the crowd, to whom he immediately diſtributed preſents; in the mean time the marines were landed, and drawn up upon the beach. The captain then made ſigns that he wanted wood, and they by ſigns gave him permiſſion to cut down the trees. A ſmall pig was preſently brought, and preſented to the captain, who in return gave the bearer a piece of cloth. It was expected from this inſtance, that an exchange of proviſions for various articles of merchandize would take place: but theſe expectation proved fallacious; no more pigs were procured, and only about half a dozen cocoa-nuts, and a ſmall quantity of freſh water. As theſe iſlanders were poſſeſſed of hogs as well as fowls, their backwardneſs to part with either might be owing to the little eſtimation in which they held ſuch articles as were tendered in barter; for they ſet no value on any nails or any other kind of iron-tools, and held all the gew-gaws of finery equally cheap. They would now and then exchange an arrow for a piece of cloth, but very ſeldom would part with a bow. After ſending on board what wood had been cut, the party all embarked, and the natives diſperſed. When the ſhip was about to leave this iſland, captain Cook gives the following relation: "When the natives ſaw us under ſail, they came off in canoes, making exchanges with more confidence than before, and giving ſuch extraordinary proofs of their honeſty as ſurpriſed us. As the ſhip at firſt had freſh way thro' the water, ſeveral of the canoes dropped aſtern after they had received goods, and before they had time to deliver theirs in return: inſtead of taking advantage of this, as our friends at the Society-iſlands would have done, they uſed their utmoſt efforts to get up with us, and deliver what they had already been paid for. One man in particular followed us a conſiderable time, and did not reach us till it was calm, and the thing was forgotten. As ſoon as he came along-ſide, he held up the article, which ſeveral on board were ready to buy: but he refuſed to part with it till he ſaw the perſon to whom he had before ſold it; and to him he gave it. The perſon not knowing the man again, offered him ſomething in return; which he refuſed; and ſhowing him what had been given before, at length made him ſenſible of the nice ſenſe of honour which had actuated this Indian."

MALLOW, a manor, and alſo a borough town in the county of Cork, and province of Munſter in Ireland, above 118 miles from Dublin. It was incorporated by charter in 1688, and ſends two members to parliament. It is pleaſantly ſituated on the north bank of the Blackwater, over which there is an excellent ſtone-bridge. Here is alſo a good church, a market houſe, and barracks for a troop of horſe. Not far diſtant is a fine ſpring of a moderately tepid water, which burſts out of the bottom of a fine limeſtone rock, and approaches the neareſt in all its qualities to the hot-well waters of Briſtol of any that has been yet diſcovered in this kingdom, which brings a reſort of good company there frequently in the ſummer months, and has cauſed it to be called the *Iriſh Bath*. Mallow is a poſt town, and has five fairs.

MALLOW, in botany. See MALVA.

Marſh-Mallow. See ALTHÆA.

Indian-Mallow. See SIDA.

MALMSBURY, a town of Wiltſhire, in England, 95 miles from London. It ſtands on a hill, with ſix bridges over the river Avon at the bottom; with which, and a brook that runs into it, it is in a manner encompaſſed. It formerly had walls and a caſtle, which were pulled down to enlarge the abbey, which was the biggeſt in Wiltſhire, and its abbots ſat in parliament. The Saxon King Athelſtan granted the town large immunities, and was buried under the high altar of the church, and his monument ſtill remains in the nave of it. The memory of Aldhelm, its firſt abbot, who was the king's great favourite, and whom he got to be canonized after his death, is ſtill kept up by a meadow near this town, called Aldhelm's Mead. By charter of King William III. the corporation conſiſts of an alderman, who is choſen yearly, 12 capital burgeſſes, and 4 aſſiſtants, land-holders and commoners. Here is an alms-houſe for 4 men and 4 women, and near the bridge an hoſpital for lepers, where it is ſuppoſed there was formerly a nunnery. This town drives a conſiderable trade in the woollen manufactory; has a market on Saturday, and three fairs. It has ſent members to parliament ever ſince the 26th of Edward I.

William of MALMSBURY. See WILLIAM.

MALO (St) a ſea-port town of France, in the province of Brittany, ſituated in the latitude of 48 degrees 38 minutes north, and 1 degree 57 minutes to the weſt. The town ſtands upon a rock called the iſland of St Aaron, ſurrounded by the ſea at high water, which is now joined to the continent, by means of a ſort of cauſey or dike, near a mile long, called the Sillon, which has been often damaged by ſtorms, and was almoſt quite ruined in the year 1730. At the end of this cauſey next the town is a caſtle, flanked with large towers, a good ditch, and a large baſtion. The city nearly covers the whole ſurface of the iſland, and is of an oblong form, ſurrounded with a ſtrong rampart, on which there is a number of cannon.—There is always in it a good garriſon. The cathedral-church is dedicated to St Vincent, and ſtands in the ſquare of the ſame name, as do alſo the town-houſe and the epiſcopal palace. There are ſome other ſquares in the place, but leſs remarkable; and as to the ſtreets, except two or three, they are all very narrow. There being no ſprings of freſh water in St Malo, the inhabitants are at great pains to convey the rain which falls on the roofs of their houſes into ciſterns; and of this they have enough for all family-uſes. There is only one pariſh-church in the town, though it contains between 9000 and 10,000 inhabitants; but there are ſeveral convents of monks and nuns, and a general hoſpital. The two entrances into the harbour are defended by ſeveral forts, ſuch as that of the Conchal; of the great and the little bay; the forts of Iſle Rebours, Sezembre, Roteneuf; the caſtle of Latte, and Fort-Royal. Theſe are ſeveral little iſles near the harbour, the moſt conſiderable whereof is that of St Sezembre, which is near a quarter of a league in circumference, and ſerve as ſo many outworks to the fortifications of the city, and are uſeful as bulwarks, by breaking the violence of the waves, which otherwiſe would beat with great force againſt the walls of the city. At the end of the cauſey next the continent ſtands the ſuburb of St Servant, large and well built. Here the merchants have their houſes and ſtore-houſes. Here is the dock-yard; and a ſecure harbour is formed by the river Rance, where ſhips of great burthen can ride at anchor very near the houſes. The harbour is one of the beſt in the kingdom, and moſt frequented by merchant-ſhips; but it is of very difficult and dangerous acceſs on account of the rocks which lie round it. The town of St Malo is exceedingly well ſituated for trade; and accordingly, in this reſpect, it has ſucceeded beyond moſt towns in France. It maintains a trade with England, Holland, and Spain.—The commerce of Spain is of all the moſt conſiderable, and moſt profitable to the inhabitants of St Malo, the ſhips of the Malouins being frequently employed as regiſter ſhips by the Spaniards, to carry out the rich cargoes to Peru and Mexico, and bring home treaſure and plate from America. The inhabitants of St Malo carry on alſo a conſiderable trade in dry and ſalted cod to Newfoundland. They ſend to this fiſhery a good many veſſels from 100 to 300 tons burden, with ſalt for the fiſh, and proviſions for ſubſiſting the crews. They carry their fiſh to Italy, Spain, and ſome to Bourdeaux and Bayonne, and bring home the returns in fruits, ſoap, oil, &c. which are diſpoſed of to great advantage at Nantz. St Malo is the capital of the biſhopric of that name, which is of conſiderable extent; and the ſoil about it produces moſt kinds of grain and fruits in great abundance. The moſt remarkable towns in the diſtrict and dioceſe of St Malo, are St Servand, Cancalle, Chateaneuf, Dinan, Tintiniac, Combourg, Montfort, Breal, Guer, Ploermel, Joſſelin, &c.

MALO, MACLOU, or *Mahout*, (Saint), the ſon of a gentleman in Great Britain, and couſin to St Magloire, was educated in a monaſtry in Ireland, and afterwards choſen biſhop of Gui-Caſtel, a dignity which his humility prevented him from accepting. The people wiſhing to compel him, he went into Brittany, and put himſelf under the direction of a holy anchoret called Aaron, in the neighbourhood of Aleth. Some time after, about the year 541, he was choſen biſhop of that city, and there cultivated piety and religion with great ſucceſs. He afterwards retired to a ſolitude near Xaintes, where he died November 15. 565. From him the city of St Malo derives its name; his body having been carried thither, after the reduction of Aleth to a ſmall village called *Guidalet* or *Guichalet*, and the tranſference of the epiſcopal ſee to St Malo

MALOUIN (Paul-Jaques), born at Caen in 1701, was profeſſor of medicine in the royal college of Paris, phyſician in ordinary to the queen, and a member of the Royal Society of London, and of the Academy of Sciences of Paris. Theſe ſtations were a proper reward for his very extenſive information in medicine and chemiſtry; and his amiable and ſteady character procured him many friends and protectors. He was very unlike ſome modern phyſicians, who put little truſt in medicine; and was greatly diſpleaſed to hear any ill ſpoken of his profeſſion. He obſerved one day to a young man who took this liberty, that all great men had reſpected medicine: *Ah!* ſaid the young fellow, *you muſt at leaſt except from the liſt one Moliere. But then*, inſtantly replied the doctor, *you ſee he is dead.* He is ſaid to have believed the certainty of his art as firmly as a mathematician does that of geometry. Having preſcribed a great many medicines for a celebrated man of letters, who followed his directions exactly, and was cured, Malouin eagerly embraced him, ſaying, *You deſerve to be ſick.* As he valued the rules of medicine ſtill more on his own account that on that of others, he obſerved, eſpecially in the latter part of his life, a very auſtere regimen. He ſtrictly practiſed the preſervative part of medicine, which is much more certain in its effects than the reſtorative. To this regimen Malouin was indebted, for what many philoſophers have deſired in vain, a healthy old age and an eaſy death. He was a ſtranger to the infirmities of age; and died at Paris of an apoplexy, the 3d of January 1778, in the 77th year of his age. By his will he left a legacy to the faculty of medicine, upon condition of their holding a public meeting every year for the purpoſe of giving the public an account of his labours and diſcoveries. Malouin was economical, but at the ſame time very diſintereſted. After two years of very lucrative practice, he left Paris and went to Verſailles, where he ſaw very few patients, obſerving that he had *retired to the court*. His principal works are, 1. *Traite de Chimie*, 1734, 12mo. 2. *Chimie medicinale*, 2 vols 12mo, 1755; a book full of curious obſervations, and written in a chaſte and well adapted ſtyle. He had the character of a laborous chemiſt, and he was a well informed and even diſtinguiſhed one for the age in which he lived; but his knowledge of chemiſtry, it muſt be confeſſed, was very imperfect, compared with the ſtate of the ſcience in the preſent age, in which it has aſſumed a new face, that probably will not be the laſt. 3. Some of the Arts in the collection publiſhed by the academy of ſciences on the arts and profeſſions. A circumſtance which happened at a meeting of the academy does as much honour to his heart, as any of his works do to his underſtanding. A new treatiſe on the art of baking, wherein ſome of Malouin's ideas were combated, was read by M. Parmentier before his fellows, among whom was the old doctor. The young academician, who knew how eaſily ſelf-love is hurt, was afraid to meet his looks: but no ſooner was the reading finiſhed, than Malouin went up to him, and embracing him, "receive my reſpects (ſaid he), you have ſeen farther into the ſubject than I did." 4. He was likewiſe the author of the chemical articles in the *Encyclopédie*.

Of the ſame family was *Charles Malouin*, who graduated as a doctor of medicine in the univerſity of Caen, and died in 1718 in the flower of his age. He publiſhed a treatiſe on Solids and Fluids, Paris 1718, 12mo.

MALPAS, a town of Cheſhire, 166 miles from London. It ſtands on a high hill, not far from the river Dee, on the borders of Shropſhire; has a grammar-ſchool, and an hoſpital, and had formerly a caſtle. It is called in Latin *Mala Platea*. i. e. "Ill Street," and was, for the ſame reaſon, by the Normans, called *Mal Pas*: but its three ſtreets, of which it chiefly conſiſts, are now well paved; and here is a benefice rich enough to ſupport two rectors, who officiate alternately in its ſtately church. It has a good market on Mondays, and three fairs in the year.

MALPIGHI (Marcellus), an eminent Italian phyſician and anatomiſt in the 17th century. He ſtudied under Maſſari and Mariano. The duke of Tuſcany invited him to Piſa, to be profeſſor of phyſic there. In this city he contracted an intimate acquaintance with Borelli, to whom he aſcribed all the diſcoveries he had made. He went back to Bologna, the air of Piſa not agreeing with him. Cardinal Antonio Pignatelli, who had known him while he was legate, at Bologna, being choſen pope in 1691, under the name of *Innocent XII*. immediately ſent for him to Rome, and appointed him his phyſician. But this did not hinder him from purſuing his ſtudies, and perfecting his works, which have immortalized his memory. He died in 1694; and his works, with his life written by himſelf prefixed, were firſt collected and printed at London, in folio, in 1667.

MALPIGHIA, Barbadoes cherry, a genus of the trigynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 23d order, *Trihilata*. The calyx is pentaphyllous, with melliferous pores on the outſide at the baſe. There are five petals roundiſh, and unguiculated: the berry unilocular, and triſpermous. There are eight or ten ſpecies, all of them ſhrubby evergreens of the warm parts of America, riſing with branchy ſtems from 8 or 10 to 15 or 20 feet high, ornamented with oval and lanceolate entire leaves, and large pentapetalous flowers, ſucceeded by red, cherry-ſhaped, eatable berries, of an acid and palatable flavour; and which, in the Weſt Indies, where they grow naturally, are uſed inſtead of cherries. Three of the ſpecies are reared in gardens, and make a fine variety in the ſtove. They retain their leaves all the year round; and begin to flower about the end of autumn, continuing in conſtant ſucceſſion till the ſpring; after which they frequently produce and ripen their fruit; which commonly equals the ſize of a ſmall cherry. The flowers are of a pale-red or purple colour. Theſe plants are propagated by ſeed, which muſt be ſown in ſpring in ſpots of rich earth: then plunge them in a hot-bed; and when the plants are three or four inches high, prick them in ſeparate ſmall pots, give water, and plunge them in the bark bed of the ſtove; where after they have remained a year or two, they may be placed in any part of it. They may even be placed in the open air during a month or two of the hotteſt weather in ſummer; but muſt be carefully ſupplied with water during the whole year.

MALPLAQUET, a village of the Netherlands, in Hainault, famous for a moſt bloody battle fought here on the 11th of September 1709, between the French under old marſhal Villars, and the allies commanded by prince Eugene and the duke of Marlborough. The French army amounted to 120,000 men; and were poſted behind the woods of La Marte and Taniers, in the neighbourhood of Malplaquet. They had fortified their ſituation in ſuch a manner with lines, hedges, and trees laid acroſs, that they ſeemed to be quite inacceſſible. In this ſituation they expected certain victory: and even the common ſoldiers were ſo eager to engage, that they flung away the bread which had been juſt given them, though they had taken no ſuſtenance for a whole day before. The allied army began the attack early in the morning, being favoured by a thick fog. The chief fury of their impreſſion was made upon the left of the enemy; and with ſuch ſucceſs, that notwithſtanding their lines and barricadoes, the French were in leſs than an hour driven from their entrenchments. But on the enemy's right the combat was ſuſtained with much greater obſtinacy. The Dutch, who carried on the attack, drove them from their firſt line; but were repulſed from the ſecond with great ſlaughter. The prince of Orange, who headed that attack, perſiſted in his efforts with incredible perſeverance and intrepidity, though two horſes had been killed under him, and the greater part of his officers ſlain and diſabled. At laſt, however, the French were obliged to yield up the field of battle; but not till after having ſold a dear bought victory. Villars being dangerouſly wounded, they made an excellent retreat under the conduct of Bouflers, and took poſt near Gueſnoy and Valenciennes. The conquerors took poſſeſſion of the field of battle, on which above 20,000 of their beſt troops lay dead. The loſs of the French, it is ſaid, did not exceed 8000; and marſhal Villars confidently aſſerted, that if he had not been diſabled, he would have gained an undoubted victory.

MALT denotes barley cured, or prepared to fit it for making a potable liquor, under the denomination of *beer* or *ale*. See Brewing.

Malt-Liquors have different names as well as different virtues, properties and uſes, both from the different manners of preparing the malt; whence they are diſtinguiſhed into *pale* and *brown*; and from the different manners of preparing or brewing the liquors themſelves; whence they are divided into *beer* and *ale*, *ſtrong* and *ſmall*, *new* and *old*.

Malt drinks are either pale or brown, as the malt is more or leſs dried on the kiln; that which is the ſlendereſt dried, tinging the liquor leaſt in brewing, and therefore being called *pale*; whereas that higher dried, and as it were roaſted, makes it of a higher colour. A mixture of both theſe makes an amber colour; whence ſeveral of theſe liquors take their name

Now, it is certain, the pale malt has moſt of the natural grain in it, and is therefore the moſt nouriſhing; but, for the ſame reaſon, it requires a ſtonger conſtitution to digeſt it. Thoſe who drink much of it, are uſually fat and ſleek in their bloom, but are often cut off by ſudden fevers: or, if they avoid this, they fall early into a diſtempered old age.

The brown malt makes a drink much leſs viſcid, and fitter to paſs the ſeveral ſtrainers of the body; but, if very ſtrong, it may lead on to the ſame inconveniences with the pale; though a ſingle debauch wears off much more eaſily in the brown.

Dr Quincy obſerves, that the beſt pale malt liquors are thoſe brewed with hard waters, as thoſe of ſprings and wells, becauſe the mineral particles, wherewith theſe waters are impregnated, help to prevent the coheſions of thoſe drawn from the grain, and enable them to paſs the proper ſecretions the better; as the viſcid particles of the grain do likewiſe defend theſe from doing the miſchief they might otherwiſe occaſion. But ſofter waters ſeem beſt ſuited to draw out the ſubſtance of high-dried malts, which retain many fiery particles in their contexture, and are therefore beſt loſt in a ſmooth vehicle.

For the differences in the preparation of malt liquors, they chiefly conſiſt in the uſe of hops, as in beer; or in the more ſparing uſe of them, as in ale.

The difference made by hops is beſt diſcovered from the nature and quality of the hops themſelves; theſe are known to be a ſubtle grateful bitter; in their compoſition, therefore, with this liquor, they add ſomewhat of an alkaline nature, *i. e.* particles that are ſublime, active, and rigid. By which means, the ropy viſcid parts of the malt are more divided and ſubtilized: and are therefore not only rendered more eaſy of digeſtion and ſecretion in the body, but alſo, while in the liquor, they prevent it from running into ſuch coheſions as would make it ropy, vapid, and ſour·

For want of this, in unhopped drinks, that clammy ſweetneſs, which they retain after working, ſoon turns them acid and unfit for uſe; which happens ſooner or latter in proportion to the ſtrength they receive from the malt, and the comminution that has undergone by fermentation.

It is a common opinion, that ale is more diuretic than beer; that is, liquor leſs hopped more than that with a greater quantity of hops in it: which may hold in ſome conſtitutions; becauſe ale being more ſmooth, ſoftening, and relaxing, where urine is to be promoted by enlarging the paſſage, as in thin, dry conſtitutions, this is the moſt likely to effect it. But, where the promoting of urine is to be done by attenuating and breaking the juices, and rendering them more fluid, it is certainly beſt anſwered by thoſe drinks which are well hopped.

As to the diſpute, whether or no hops tend to breed the ſtone; it is too long to enter upon here. Quincy is of opinion, there is but little reaſon for the affirmative ſide of the queſtion; and in the general, makes no ſcruple to ſay, that, for one conſtitution damaged by beer, there are numbers ſpoiled by ale. This laſt manifeſtly fouls the glands, ſtuffs the veſſels with ſlime and viſcidity, makes the body unwieldy and corpulent, and paves the way for cachexies, jaundice, aſthmas, and at laſt incurable dropſies. The urinary paſſages, alſo, which it is ſuppoſed to clear, will, in time, be filled by it with ſlough and matter of as ill conſequence as gravel.

The different ſtrengths of malt liquors alſo make their effects different. The ſtronger they are, the more viſcid parts they carry into the blood; and though the ſpiritous parts make theſe imperceptible at firſt: yet when thoſe are evaporated, which will be in a few hours, the other will be ſenſibly felt by pains in the head, nauſeouſneſs at the ſtomach, and laſſitude or liſtleſſneſs to motion. This thoſe are the moſt ſenſible of who have experienced the extremes of drinking theſe liquors and wines, for a debauch of wine they find much ſooner worn off, and they are much more lively and briſk afterwards, than after fuddling, malt liquors, whoſe viſcid remains will be long before they be ſhaken off.

Malt liquors therefore are, in general, the more wholeſome for being ſmall; *i. e.* of ſuch a ſtrength as is liable to carry a ſmall degree of warmth into the ſtomach, but not ſo great as to prevent their being proper diluters of the neceſſary food. Indeed, in robuſt people, or thoſe who labour hard, the viſcidities of the drink may be broken into convenient nouriſhment; but in perſons of another habit and way of living, they ſerve rather to promote obſtructions and ill humours.

The age of malt liquors is the laſt thing by which they are rendered more or leſs wholeſome. Age ſeems to do nearly the ſame thing as hops; for thoſe liquors which are longeſt kept are certainly the leaſt viſcid; age breaking the viſcid parts, and by degrees rendering them ſmaller, and fitter for ſecretion.

But this is always determined according to their ſtrength; in proportion to which, they will ſooner or latter come to their full perfection as well as decay; for, when ale or beer is kept till its particles are broken and comminuted as far as they are capable, then it is that they are beſt; and, beyond this, they will be continually on the decay, till the finer ſpirits are entirely eſcaped, and the remainder becomes vapid and ſour.

Malt-Diſtillery. This is an extenſive article of trade, and by which very large fortunes are made. The art is to convert fermented malt liquors into a clear inflammable ſpirit, which may be either ſold for uſe in the common ſtate of a proof ſtrength, that is, the ſame ſtrength with French brandy; or is rectified into that purer ſpirit uſually ſold under the name of *ſpirit of wine;* or made into compound cordial waters, by being diſtilled again from herbs and other ingredients. See Brewing and Wash.

To brew with malt in the moſt advantageous manner, it is neceſſary, 1. That the ſubject be well prepared; 2. That the water be ſuitable and duly applied; and, 3. That ſome certain additions be uſed, or alterations made, according to the ſeaſon of the year, and the intention of the operator; and by a proper regulation in theſe reſpects, all the fermentable parts of the ſubject will thus be brought into the tincture, and become fit for fermentation.

The due preparation of the ſubject conſiſts in its being juſtly malted and well ground. When the grain is not ſufficiently malted, it is apt to prove hard, ſo that the water can have but very little power to diſſolve its ſubſtance; and if it be too much malted, a part of the fermentable matter is loſt in that operation. The harder and more flinty the malt is, the finer it ought to be ground; and in all caſes, when intended for diſtillation, it is adviſable to reduce it to a kind of finer or coarſer meal. When the malt is thus ground, it is found by experience that great part of the time, trouble, and expence of the brewing is ſaved by it, and yet as large a quantity of ſpirit will be produced; for thus the whole ſubſtance of the malt may remain mixed among the tincture, and be fermented and diſtilled among it. This is a particular that very well deſerves the attention of the malt diſtiller as that trade is at preſent carried on; for the diſpatch of the buſineſs, and the quantity of ſpirit procured, is more attended to than the purity or perfection of it.

The ſecret of this matter depends upon the thoroughly mixing or briſkly agitating and throwing the meal about, firſt in cold and then in hot water; and repeating this agitation after the fermentation is over, when the thick turbid waſh being immediately committed to the ſtill already hot and dewy with working, there is no danger of burning, unleſs by accident, even without the farther trouble of ſtirring, which in this caſe is found needleſs, though the quantity be ever ſo large, provided that requiſite care and cleanlineſs be uſed; and thus the buſineſs of brewing and fermenting may very commodiouſly be performed together, and reduced to one ſingle operation. Whatever water is made choice of, it muſt ſtand in a hot ſtate upon the prepared malt, eſpecially if a clear tincture be deſired, but a known and very great inconvenience attends its being applied too hot, or too near to a ſtate of boiling, or even ſcalding with regard to the hand. To ſave time in this caſe, and to prevent the malt running into lumps and clods, the beſt way is to put a certain meaſured quantity of cold water to the malt firſt; the malt is then to be ſtirred very well with this, ſo as to form a ſort of thin uniform paſte or pudding; after which the remaining quantity of water required may be added in a ſtate of boiling, without the leaſt danger of making what, in the diſtillers language, is called a *pudden*.

In this manner the due and neceſſary degree of heat in the water, for the extracting all the virtues of the malt, may be hit upon very expeditiouſly, and with a great deal of exactneſs, as the heat of boiling water is a fixed ſtandard which may be let down to any degree by a proportionate mixture of cold water, due allowances being made for the ſeaſon of the year, and for the temperature of the air.

The little obvious improvement, added to the method juſt above hinted for the reducing brewing and fermentation to one operation, will render it practicable to very conſiderable advantage, and the ſpirit improved in quality as well as quantity.

A much more profitable method than that uſually practiſed for the fermenting malt for diſtillation, in order to get its ſpirit, is the following: take ten pounds of malt reduced to a fine meal, and three pounds of common wheat-meal; add to theſe two gallons of cold water, and ſtir them well together; then add five gallons of water, boiling hot, and ſtir altogether again. Let the whole ſtand two hours, and then ſtir it again; and when grown cold, add to it two ounces of ſolid yeaſt, and ſet it by looſely covered in a warmiſh place to ferment.

This is the Dutch method of preparing what they call the *waſh for malt ſpirit,* whereby they ſave much trouble and procure a large quantity of ſpirit: thus commodiouſly reducing the two buſineſſes of brewing and fermenting to one ſingle operation. In England the method is to draw and maſh for ſpirit as they ordinarily do for beer, only inſtead of boiling the wort, they pump it into large coolers, and afterwards run it into their fermenting backs, to be there fermented with yeaſt. Thus they beſtow twice as much labour as is neceſſary, and loſe a large quantity of their ſpirit by leaving the groſs bottoms out of the ſtill for fear of burning.

All ſimple ſpirits may be conſidered in the three different ſtates of low wines, proof ſpirit, and alcohol, the intermediate degrees of ſtrength being of leſs general uſe; and they are to be judged of only according as they approach to or recede from theſe. Low wines at a medium contain a ſixth part of pure inflammable ſpirit, five times as much water as ſpirit neceſſarily ariſing in the operation with a boiling heat. Proof goods contain about one half of the ſame totally inflammable ſpirit; and alcohol entirely conſiſts of it.

Malt low-wines, prepared in the common way, are exceedingly nauſeous; they have, however, a natural vinoſity, or pungent agreeable acidity, which would render the ſpirit agreeable to the palate were it not for the large quantity of the groſs oil of the malt that abounds in it. When this oil is detained in ſome meaſure from mixing itſelf among the low wines, by the ſtretching a coarſe flannel over the neck of the ſtill or at the orifice of the worm, the ſpirit becomes much purer in all reſpects; it is leſs fulſome to the taſte, leſs offenſive to the ſmell, and leſs milky to the eye. When theſe low wines, in the rectification into proof-ſpirits, are diſtilled gently, they leave a conſiderable quantity of this groſs fetid oil behind them in the ſtill along with the phlegm; but if the fire be made fierce, this oil is again raiſed and brought over with the ſpirit; and being now broken ſomewhat more fine, it impregnates it in a more nauſeous manner than at firſt. This is the common fault both of the malt diſtiller and of the rectifier; the latter, inſtead of ſeparating the ſpirit from this naſty oil, which is the principal intent of his proceſs, attends only to the leaving the phlegm in ſuch quantity behind, that the ſpirit may be of a due ſtrength as proof or marketable goods, and brings over the oil in a worſe ſtate than before. To this inattention to the proper buſineſs of the proceſs, it is owing, that the ſpirit, after its ſeveral rectifications, as they are miſcalled, is often found more ſtinking than when delivered out of the hands of the malt diſtiller. All this may be prevented by the taking more time in the ſubſequent diſtillations, and keeping the fire low and regular; the ſudden ſtirring of the fire, and the haſty way of throwing on the freſh fuel, being the general occaſion of throwing up the oil by ſpurts, where the fire in general, during the proceſs, has not been ſo large as to do that miſchief.

The uſe of a balneum mariæ, inſtead of the common ſtill, would effectually prevent all this miſchief, and give a purer ſpirit in one rectification than can otherwiſe be produced in ten, or indeed according to the common methods at all.

Malt low wine, when brought to the ſtandard of proof ſpirit, loſes its milky colour, and is perfectly clear and bright, no more oil being contained in it than is perfectly diſſolved by the alcohol, and rendered miſcible with that proportion of phlegm, which is about one half the liquor: its taſte alſo is cleaner, tho' not more pleaſant; there being leſs of the thick oil to hang on the tongue than its own form; which is not the caſe in the low wines, where the oil being undiſſolved, adheres to the mouth in its own form, and does not paſs lightly over it.

When proof-ſpirit of malt is diſtilled over again, in order to be rectified into alcohol, or, as we uſually call it, ſpirits of wine, if the fire be raiſed at the time when the faints begin to fall off, a very conſiderable quantity of oil will be raiſed by it, and will run in the viſible form of oil from the noſe of the worm. This is not peculiar to malt ſpirit; but the French brandy ſhows the ſame phenomenon, and that in ſo great a degree, that half an ounce of this oil may be obtained from a ſingle piece of brandy.

Malt ſpirit, more than any other kind, requires to be brought into the form of alcohol, before it can be uſed internally, eſpecially as it is now commonly made up in the proof ſtate with as much of this nauſeous and viſcous oil as will give it a good crown of bubbles. For this reaſon it ought to be reduced to an alcohol, or totally inflammable ſpirit, before it is admitted into any of the medicinal compoſitions. If it be uſed without this previous caution, the odious taſte of the malt oil will be diſtinguiſhed among all the other flavours of the ingredients.

Malt ſpirit, when it has once been reduced to the true form of an alcohol, is afterwards more fit for all the curious internal uſes than even French brandy; it being after this purification a more uniform, hungry, taſteleſs, and impregnable ſpirit, than any other ſpirits which we eſteem ſo much finer.

A pure ſpirit being thus procured, ſhould be kept carefully in veſſels of glaſs or ſtone, well ſtopped, to prevent the evaporation of any of its volatile part. If preſerved in caſks, it is apt to impregnate itſelf very ſtrongly with the wood. The quantity of pure alcohol obtainable from a certain quantity of malt, differs according to the goodneſs of the ſubject, the manner of the operation, the ſeaſon of the year, and the ſkilfulneſs of the workmen; according to which variations, a quarter of malt will afford from eight or nine to thirteen or fourteen gallons of alcohol. This ſhould encourage the malt diſtiller to be careful and diligent in his buſineſs, as ſo very large a part of his profit depends wholly on the well conducting his proceſſes. After every operation in this buſineſs, there remains a quantity of faints, which in their own coarſe ſtate ought never to be admitted into the pure ſpirit; theſe are to be ſaved together, and large quantities of them at once wrought into alcohol. It is eaſy to reduce thoſe to ſuch a ſtate that they will ſerve for lamp-ſpirits. This diſagreeable flavour being corrected by the adding of aromatics during the diſtillations, the reducing them into a perfect and pure alcohol is practicable, but not without ſuch difficulties as render it ſcarce worth the trader's while. One way of doing it is by diſtilling them from water into water, and that with a very ſlow fire. By this means a pure alcohol may be made out of the fouleſt faints.

The malt diſtiller always gives his ſpirit a ſingle rectification *per ſe*, in order to purify it a little, and make it up proof; but in this ſtate it is not to be reckoned fit for internal uſes, but ſerves to be diſtilled into geneva and other ordinary compound ſtrong waters for the vulgar.

The Dutch, who carry on a great trade with malt ſpirit, never give it any farther rectification than this; and it is on this account, that the malt ſpirit of England is in general ſo much more in eſteem. The Dutch method is only to diſtill the waſh into low wines, and then to full proof ſpirit; they then directly make it into geneva, or elſe ſend it as it is to Germany, Guinea, and the Eaſt-Indies; for the Dutch have little notion of our rectifications. Their ſpirit is by this means rendered very foal and coarſe, and is rendered yet more nauſeous by the immoderate uſe they make of rye-meal. Malt ſpirit, in its unrectified ſtate, is uſually found to have the common bubble proof, as the malt diſtiller knows that it will not be marketable without it.

The whole matter requiſite to this is, that it have a conſiderable portion of the groſs oil of the malt well broke and mixed along with it; this gives the rectifier a great deal of trouble if he will have the ſpirit fine; but in the general run of the buſineſs, the rectifier does not take out this oil, but breaks it finer, and mixes it faſter in by alkaline ſalts, and diſguiſes its taſte by the addition of certain flavouring ingredients. The ſpirit loſes in theſe proceſſes the vinoſity it had when it came out of the hands of the malt diſtiller, and is in all reſpects worſe, except in the diſguiſe of a mixed flavour.

The alkaline ſalts uſed by the rectifier deſtroying the natural vinoſity of the ſpirit, it is neceſſary to add an extraneous acid in order to give it a new one. The acid they generally uſe is the ſpiritus nitri dulcis; and the common way of uſing it is the mixing it to the taſte with the rectified ſpirit: this gives our malt ſpirit, when well rectified, a flavour ſomewhat like that of French brandy, but this ſoon flies off; and the better method is to add a proper quantity of Glauber's ſtrong ſpirit of nitre to the ſpirit in the ſtill. The liquor in this comes over impregnated with it, and the acid being more intimately mixed, the flavour is retained.

Malt Bruiſer, or *Bruiſing mill*. It has been found by repeated experiments, that bruiſing malt is a more advantageous method than the old one of grinding and flouring. By bruiſing, there is not only leſs waſte, but the malt is alſo better fitted for giving out all its virtues. It has lately, therefore, become a practice to ſqueeze malt between rollers, by means of a proper apparatus, of which various conſtructions have been invented. As the beſt contrivance of this ſort is ſaid to be the bruſing-mill of Mr Winlaw, we have given a figure of it on Plate CCLXXXII. where AAAA is the frame; B, the large cylinder or roller; C, the ſmall one: D, the hopper: E, the ſhoe; F, the frame that ſupports the hopper; G, a fly-wheel; H, the windlas. To uſe this engine, it is directed to ſcrew the large roller up to the ſmall one, and not to feed too faſt from the ſhoe, which is regulated by pins that have ſtrings fixed to them. It is evident that when two ſmooth ſurfaces are oppoſed to each other at a diſtance which can be regulated at pleaſure, neither grain nor any other ſimilar ſubſtance can paſs between them without being bruiſed. This being the principle on which the bruſing-mill acts, the meally ſubſtance, which is the eſſential part of malt, is entirely removed from the ſkin or huſk which contains it, and all the virtues of the malt are with eaſe extracted by the water in a manner ſuperior to what is effected when the grain is only cut by grinding. The operation is at the ſame time ſo expeditiouſly performed that two men can with eaſe bruiſe a buſhel of malt in a minute.—By the ſame engine may alſo be bruiſed oats and beans for horſes. A great part of the corn given theſe animals it is well known, is ſwallowed whole, and after paſſes through them in the ſame ſtate; in which caſe, they cannot receive any nouriſhment from the grains that are unbroken; but when bruiſed in this engine, it eaſes maſtication; and every grain being prepared for nutrition, a much leſs quantity will of coarſe be found to be ſufficient. For bruiſing beans the two regulating ſcrews muſt be unſcrewed a little; and the fly-wheel requires to be then ſet in motion with the hand, on account that the rollers are then a little ſpace apart, and will not turn each other before the beans come between them.

Malt-Tax, is the ſum of 750,000l. raiſed every year by parliament ſince 1697, by a duty of 6d. on the buſhel of malt, and a proportionable ſum on certain liquors, ſuch as cyder and perry, which might otherwiſe prevent the conſumption of malt. This is under the management of the commiſſioners of the exciſe; and is indeed itſelf no other than the annual exciſe. 1760, an additional perpetual exciſe of 3d. per buſhel was laid upon malt; and in 1763, a proportional exciſe was laid upon cyder and perry, but new-modelled 1766. See Excise.

1
Ancient hiſtory of the iſland.

MALTA, a celebrated iſland of the Mediterranean ſituated between the 15th and 16th degrees of eaſt longitude, and between the 35th and 36 degrees of north latitude. It is about 19 or 20 leagues in length, nine or ten in breadth, and 90 in circumference. Anciently it was called *Melita*; and is ſuppoſed by Cluverius, from its ſituation and other particulars, to be the Hiperia mentioned by Homer, whence the Pheaces were afterwards driven by the Phenicians, and retired into Sheria and the iſland of Corfu; which is the more probable, as the ancient poet places the mountain Melita in that iſland. He has likewiſe brought ſome probable arguments to prove, that Melita or Malta is the ancient *Ogygia*; in which the famed nymph *Calypſo*, daughter of the Ocean and Thetis, received the ſhipwrecked Ulyſſes, and detained him ſeven years.

The moſt ancient poſſeſſors of Malta, of whom we have any certain account, were the Carthaginians; from whom it was taken by the Romans; and yet during the whole time that it continued under the power of theſe polite nations, it was almoſt entirely barren. The ſoil was partly ſandy and partly rocky, having ſcarcely any depth of earth; and withal ſo ſtony, that it was hardly capable of producing corn or any other grain except cummin, and ſome ſeeds of a ſimilar nature. Its chief products were figs, melons, honey, cotton, and ſome few other fruits and commodities, which the inhabitants exchanged for corn; and in this barren ſtate it ſeems to have continued till it came into the poſſeſſion of the Malteſe knights. It laboured alſo under great ſcarcity of water and fuel; upon all which accounts it was till that time but thinly inhabited, their being only about 30 or 40 boroughs or other villages ſcattered about, and no city except the capital called alſo *Malta*, and the town and fort of St Angelo, which defended the harbour; ſo that the whole number of its inhabitans did not exceed 12,000, including women and children; the greateſt part of whom were very indigent.

According to an ancient tradition, Malta was firſt poſſeſſed by an African prince named *Battus*, an enemy to queen Dido, from whom it was taken by the Carthaginians, as may be juſtly inferred from ſeveral Punic inſcriptions to be ſeen on ſtone pillars and other monuments yet ſtanding. From the Carthaginians it paſſed to the Romans, who made themſelves maſters of it at the ſame time that they ſubdued the iſland of Sicily. Theſe were driven out by the Arabs in the year 828; who were driven out of it in their turn by Roger the Norman, earl of Sicily, who took poſſeſſion of it in 1190; from which time it continued under the dominion of the Sicilian princes till the time of Char. V. when it fell under his power, along with Naples and Sicily. To cover the iſland of Sicily from the Turks, Charles gave the iſland to the *knights of Rhodes*, ſince that time called *knights of Malta*.

2
Malta given to the knights of Rhodes.

The origin and hiſtory of theſe knights is given under

der the article *Knights of* MALTA and RHODES. Here it is ſufficient to obſerve, that in 1530, the knights of Rhodes having been expelled from that iſland by Soliman the Turkiſh ſultan, and deſtitute of an habitation, accepted, tho' not without ſome reluctance on account of its barrenneſs, the offer made them by Charles V. of the iſland of Malta. The grand maſter having cauſed his two large carracks, the galleys of the order, and a good number of other tranſport-ſhips laden with great quantities of arms, ammunition, and troops, to be got ready, he and his knights embarked in the former, with all the effects, records, and treaſure belonging to the order, and the reſt in the latter. In their paſſage they ſuffered very much by a violent ſtorm; in which one of their galleys ſplit upon a rock, and one of the carracks was run aground by the violence of the waves, after having broke her three anchors. She ſtuck ſo faſt that they expected every moment to ſee her ſplit in pieces; when providentally a contrary wind diſengaged her without damage. This event was counted as a lucky omen, and on the 26th of October that year all the company were ſafely landed.

At the firſt landing of the Malteſe knights, they found themſelves obliged to lodge in a very poor town or borough at the foot of the hill on which ſtands the caſtle of St Angelo, and where their only habitations were fiſhermens huts. The grand-maſter, with the principal knights, took poſſeſſion of the caſtle, where the accommodations were ſomewhat better: tho' theſe too were very mean, and out of repair. Three days after, he took poſſeſſion of the city, which was formerly called *Malta*, but ſince that time hath taken the name of the *Notable City;* and after that, of the whoſe iſland of Malta, and the neighbouring one of Goſa.

The firſt care of the knights, after having ſettled their authority through the two iſlands, was to provide ſome better accommodation for the preſent, and to chooſe a proper place where to fix their habitation. But as the iſland had no other defence than the old caſtle of St Angelo, and was ſo much expoſed on all ſides, that it would have required greater ſums than their exhauſted treaſury could ſpare to put it in a proper ſtate of defence; the grand maſter was obliged to content himſelf with ſurrounding the borough abovementioned, wherein he had ordered new buildings to be reared for the preſent habitation of his knights, with a ſtout wall, to prevent its being ſurpriſed by the Turkiſh and Barbary corſairs. His deſign indeed, at this time, was not to have fixed the abode of the knights in the bare and defenceleſs iſland of Malta, but to ſtay in it only till he had got a ſufficient force to attempt the conqueſt of *Modon*, a town of the Morea, and which was not only a populous and opulent place, but lay very convenient for making an attempt on the iſland of Rhodes, their ancient habitation, and to which they were naturally attached. This, however, did not hinder his taking all proper meaſures for ſecuring Malta as well as Goſa, and laying out a proper plan for ſecuring them from attacks, in caſe the deſign on Modon ſhould fail.

3
They attempt the conqueſt of Modon without ſucceſs.

In the mean time, as ſuperſtition was then univerſally prevalent, the grand-maſter, among other precious relics which they had brought from Rhodes, cauſed to the arm of St Catherine to be carried in proceſſion to the cathedral. Whilſt they were on their march, one of the centinels gave them notice, that a large Turkiſh merchantman was wrecked on their coaſt. The grand-maſter immediately diſpatched ſome of his knights and ſoldiers thither; who finding Iſaac the patron of the ſhip, a native of Modon, aud one Maurithiſala Nocher, an excellent engineer, they were retained in the ſervice of the order, and the latter was immediately employed in fortifying the iſland.

The knights were hardly ſettled in Malta, when the emperor, and other European potentates, endeavoured to engage them in a war with the inhabitants of Barbary, as the city of Tripoli, then held by Charles, was in great danger of falling into the hands of the infidels. The attempt on Modon, however, was firſt made; but it proved unſucceſsful through the baſe avarice of the Malteſe forces: for they having been admitted into the city, during the night began to murder and plunder the inhabitants, without waiting for the arrival of the galleys which were coming to their aſſiſtance. The conſequence was, that the inhabitants armed, and a deſperate battle began; in which the Malteſe, notwithſtanding the utmoſt efforts, were obliged to retire, but not till they had loaded themſelves with plunder, and carried away 800 women captives.

4
Join the emperor againſt the Turks.

The grand-maſter, looking upon this diſapointment as a ſign that Providence had ordained Malta to be the reſidence of the knights, did not renew his attemps upon Modon; but, in 1532, joined with the emperor againſt the Turks, and ſent a great number of his galleys to join the confederate fleet under the celebrated Andrew Doria. In conſequence of this aid, the undertaking proved ſucceſsful; and in all probability the conqueſt of Modon would have been accompliſhed, had not the ſoldiery diſcouraged by the bad ſucceſs of the laſt attempt, openly refuſed to proceed, and obliged the emperor to proceed to Coran, another town belonging to the Turks. Through the valour of the Malteſe knights, this place was ſoon obliged to capitulate; and in a ſecond expedition in 1533, the knights again diſtinguiſhed themſelves in a moſt eminent manner. They were quickly recalled, however, by the grand-maſter to the defence of the iſland, which was now threatened with an invaſion by Barbaroſſa the celebrated Turkiſh corſair, who ſcoured thoſe ſeas at the head of above fourſcore galleys. This invaſion, however, did not take place; and in 1534 the grand-maſter Villiers de L'Iſle Adam died, and was ſucceeded by Perino de Ponte, a native of the town of Aſt in Italy.

The new grand-maſter, who received intelligence of his election at St Euphemia in Calabria, very ſoon after received another expreſs, giving an acount of the wars which in that time reigned in Tunis, and the danger that Tripoli as well as Malta was in from Barbaroſſa, who was by this time become maſter both of Algiers and Tunis; upon which he made all the haſte he could to his new government. His firſt care was to ſend a ſtrong reinforcement to Italy; after which, he diſpatched an embaſſy to the emperor, intreating him to equip a powerful fleet againſt Barbaroſſa, without which it would be impoſſible for Tripoli to hold out much longer.

5 Africa invaded by Charles.

By this embaſſy from De Ponte, and another to the ſame purpoſe from Muley Haſſan, the depoſed king of Tunis, Charles was eaſily prevailed on to carry his arms into Africa ; in which he was aſſiſted by a great number of the braveſt knights, together with 18 brigantines of different ſizes, four of the beſt Malteſe galleys, and their veſſel called the *great carrack*, of itſelf almoſt equivalent to a ſquadron. In this expedition the knights diſtinguiſhed themſelves in a moſt eminent manner. At the ſiege of Goletta, one of the knights, named *Converſa*, an excellent engineer, by means of a *barcalonga*, got almoſt cloſe to the great tower, which he furiouſly battered with large cannon, while the great carrack, which was behind all the reſt of the veſſels, and by reaſon of its height could fire over them, did prodigious execution. A breach was ſoon made ; and hardly was it wide enough to be ſcaled, when the Malteſe knights jumped out of the galleys into their long-boats, and thence into the ſea, with their ſwords in their hands, and waded through the water above their girdles, it being too ſhallow for boats to approach the ſhore. The ſtandard-bearer of the order was the firſt that jumped into the water, and led the reſt to the attack ; they claiming every where the poſt of honour. They marched with the greateſt reſolution through the moſt terrible firing and ſhowers of all kinds of miſſile weapons ; and, having gained the ſhore, quickly aſcended the breach, on the top of which they planted their great ſtandard. A great number loſt their lives, and ſcarce one came off unwounded ; but the emperor did them the juſtice to own, that the taking the place was chiefly owing to the valour of the Malteſe knights.

6 Deſperate valour of the Malteſe knights.

The city of Tunis was ſoon taken after the fortreſs of Goletta ; on the ſurrender of which, the emperor, deſigning to return into Europe, took his laſt dinner on board the great carrack ; where he was magnificently entertained, and beſtowed on the ſurviving knights the greateſt encomiums, and marks of his eſteem and gratitude to the owner. Theſe he accompanied with conſiderable preſents and with two new grants. By the firſt, they were allowed to import corn and other proviſions from Sicily, without paying duty ; and by the ſecond, the emperor engaged, that none of the order ſhould enjoy any of the eſtates or revenues, due to Malteſe knights, throughout all his dominions, unleſs they were lawfully authorized by the grand-maſter and his council ; or till the originals had been examined and regiſtered by himſelf, or ſuch miniſters as he ſhould appoint for that purpoſe. The fleet then ſet ſail for Malta ; where, on their arrival, they received the news of the grand-maſter's death, who was ſucceeded by Didier de Tolon de St Jalle, a native of Provence, and then grand prior of Tholouſe, where he reſided at the time of his election.

7 Privileges conferred upon them by the emperor.

8 The Turks make an unſucceſsful attempt on Tripoli.

The preſent grand maſter was a man of great conduct and bravery, which he had formerly ſhown at the ſiege of Rhodes ; and the ſituation of affairs at this time required a perſon of experience. The Turkiſh corſairs, quite tired out with the dreadful havoc made among them by Botigella, grand prior of Piſa, who ſeldom quitted the ſea, and never failed out without ſinking ſome of them, or making conſiderable prizes, had agreed to enter into a ſtrong confederacy, either to ſurpriſe the city of Tripoli where his retreat was, or, if that failed, to lay ſiege to it by ſea and land ; in either of which attempts, they were ſure of all the aſſiſtance of Barbaroſſa and Hayradin, then lord of Tagiora. This laſt had undertaken the command and conduct of the whole enterpriſe ; but the governor being informed of the deſign, prepared to give him a warm reception. Hayradin came thither with his whole force in the dead of the night, and began to ſcale the walls in thoſe places where he reckoned them to be moſt defenceleſs. They no ſooner appeared at the foot of them, than the garriſon, which had been kept up in arms, poured down ſuch ſtreams of wild-fire, boiling oil, melted lead, &c. and threw ſuch volleys of ſtones, while the great and ſmall guns ſo annoyed thoſe that ſtood fartheſt off, that great numbers of them were deſtroyed. They perſiſted in the attack, however, with great fury and vigour, till Hayradin, who was foremoſt in one of the ſcalades, was knocked down by a muſket-ſhot from the top of his ladder. He fell into the ditch, and was taken up almoſt dead ; upon which his troops inſtantly diſperſed themſelves, and abandoned the enterpriſe. The governor of Tripoli, however, judging that this would not be the laſt viſit of the kind which in all probability he would receive, immediately diſpatched an expreſs to Malta, with propoſals for fortifying the city, and demoliſhing a ſtrong tower on that coaſt named *Alcaid*, which was held by a Turkiſh corſair. His adviſe being approved of, the commander Botigella, now general of the galleys, was immediately diſpatched with a ſufficient force ; who, having landed his men at Tripoli, immediately marched, with them and a body of Arab mercenaries towards Alcaid ; and without ſtaying to open the trenches or any other covering than his gabions, levelled his artillery againſt it. Hayradin being informed of this, came with his Turks to its defence ; but was intercepted by a ſtrong detachment of Malteſe knights at the head of the hired Arabs, and repulſed with loſs ; ſo that all he could do was to convey about 50 or 60 Turks into the place, and to annoy the Chriſtians with ſome ſlight ſkirmiſhes. Botigella, perceiving that his cannon did not make ſuch quick diſpatch as he wiſhed, ſent ſome of his galleys ; under the ſhelter of which he quickly ſprung a mine, which brought down part of the wall, and buried moſt of the coarſairs under it ; upon which the reſt, ſeeing the Malteſe knights mount the breach ſword-in-hand, immediately threw down their arms. The tower was then razed to the ground ; after which Botigella marched to a town called *Adabus*, whence he drove Hayradin, who had entrenched himſelf in it, and gave the plunder to the Arabs. In his return he attacked and took a large Turkiſh galley, the cargo of which was valued at 160,000 crowns, and had on board 200 perſons ; ſo that he landed in triumph, and was received with the loud acclamations of the whole order, who came to meet him on his arrival. Soon after the grand-maſter fell ſick and died, and was ſucceeded by John de Homedes.

The Malteſe ſtill continued to behave with their uſual valour againſt the Turks ; but, through the negligence of Charles V. almoſt all the places held by the Chriſtians on the African coaſt were reduced by the infidels, and the valour exerted by the Malteſe ſerved only to deſtroy great numbers of them. At laſt the emperor's affairs in Africa were totally ruined by

9
The emperor ſaved by the valour of the Malteſe knights.

his unſucceſsful expedition againſt ALGIERS, an account of which was given under that article, nº 12—18. Here indeed it is thought that the emperor himſelf could not have eſcaped, had not the Malteſe knights repulſed the Turks, who had attacked even the Imperial quarters. They purſued them even to the gates of the city, and were in hopes of entering it with them; but the governor having cauſed the gates to be ſhut before the Turks had all got in, the knights were diſappointed. When the Spaniſh troops reimbarked, the Malteſe were alſo of great ſervice in repulſing the enemy; and indeed behaved on both occaſions with ſo much valour and intrepidity, that the reſt of the allies could not ſufficiently admire them. The misfortune, however, was, that the loſs they ſuffered both of men and ſhips, eſpecially by ſome of their beſt commanders, more than counterbalanced the glory they had gained. The emperor, before they parted, gave them the moſt ample teſtimony of his ſatisfaction and gratitude, as far as words and encomiums could go; after which the Malteſe commander ſet ſail, with the ſmall remains of the knights, in three ſhattered veſſels, and arrived ſafely at the port of Malta about the end of November 1548.

While the Malteſe were employed in this unfortunate expedition, the iſland was ſo terribly annoyed by the Turkiſh and other corſairs, that the port was in ſome meaſure blocked up by them; whilſt the coaſts, both here and at Goſa, lay expoſed to frequent inſults and depredations, and often to the loſs of their inhabitants. This obliged the Malteſe admiral Simeoni to refit his galleys with all poſſible expedition, and again put to ſea in queſt of theſe enemies. In this enterpriſe he ſucceeded ſo well, that he ſent home a great number of the corſair captains in chains. Being obliged to put in at the port of Tripoli, the governor informed him, that he had juſt received an expreſs from the king of Tunis, acquainting him that Barbaroſſa was making the moſt preſſing complaints to the Porte againſt the Malteſe knights, whilſt his lieutenant Morat Haga was making great preparations at Tachora for the ſiege of Tripoli, which he doubted not would be followed by that of Tunis; the king having become odious to the Turks and Moors on account of his alliance with the emperor; after whoſe late diſaſter a great number of towns in that kingdom had revolted from him, and a much greater number of his ſubjects had put themſelves under the protection of the Algerine monarch, who was expected ſhortly from Conſtantinople at the head of a powerful fleet.

10
The Turks take Tripoli, and reſolve to expel the knights from Malta.

On the receipt of theſe unwelcome news, an embaſſy was ſent to the emperor, in order to perſuade him to cauſe the fortifications of Tripoli to be repaired; but without ſucceſs. All that could be obtained was fair words and promiſes; the conſequence of which was, that the Malteſe made moſt violent and almoſt incredible exertions againſt their enemies; till at laſt Soliman reſolved to expel the knights from Malta, as he had before done from Rhodes. To this he was chiefly inſtigated by Dragut, an old experienced corſair, who had obtained the command of his fleet after the death of Barbaroſſa. The ſiege was accordingly commenced in 1551; but by a ſtratagem, the Turkiſh commander was induced to depart. However, he reduced the caſtle of Goſa and the city of Tripoli. Nothing happened of great conſequence from that time till the year 1564. when freſh complaints being made to Soliman, he propoſed, in a grand council, where moſt of his officers attended, to extirpate the knights altogether. This deſign was ſtrenuouſly oppoſed by Hali, one of Dragut's moſt experienced captains, who offered the moſt ſolid reaſons againſt it; but being overruled by the reſt, an expedition againſt Malta was reſolved upon. One of the ſultan's firſt cares was to ſend ſome ſpies, in the diſguiſe of fiſhermen, to take a full view of the iſland, who found means to bring him an exact plan of it, with all its fortifications, havens, ſtrength, the number of its inhabitants, &c. whilſt he was haſtening his armaments againſt it. By this time, as the Malteſe had very little reaſon to doubt that the Turkiſh armaments were deſigned againſt their iſland, the viceroy of Sicily, Don Garcia, was ordered by his maſter to take it in his way to the caſtle of Goletta, in order to conſult with the grand maſter about the neceſſary means for oppoſing ſuch a formidable power. The grand-maſter acquainted him that, in caſe of an attack upon Malta, he ſhould want both men an corn; upon which the viceroy engaged to ſupply him with both on his return to Sicily; in pledge of which he left one of his ſons with him, who was afterwards admitted into the order. He was no ſooner departed, than the grand maſter ſummoned all the knights of the order, diſperſed through ſeveral parts of Europe to repair to him. Thoſe that were in Italy raiſed a body of 2000 foot, to which the viceroy of Sicily added two companies of Spaniſh forces. All the galleys of the order were employed in tranſporting theſe troops, together with all manner of proviſions and ammunition into the iſland; and the knights that were in it, in diſtributing, diſciplining, and exerciſing their new levies, as well as the Malteſe militia, againſt the ſiege. Thus the grand-maſter ſaw himſelf ſtrengthened by the arrival of 600 knights, all of whom brought with them retinues of ſtout good ſervants, fit to aſſiſt in the defence of the iſland; whilſt thoſe who, by reaſon of age ſickneſs, or other impediments could not to repair to him, ſold their moſt valuable effects in order to aſſiſt him with their purſes. The pope on his part, contented himſelf with ſending a ſupply of 10,000 crowns; and the king of Spain ordered his viceroy Don Garcia to raiſe an army of 20,000 men, to be ready to ſail thither as ſoon as called for. The grand-maſter employed the remainder of his time in viſiting all the forts, magizines, arſenals, &c. and aſſigning to each tongue their ſeveral poſts, and making all neceſſary preparations, till the Ottoman fleet appeared in ſight on the 18th of May 1565. It conſiſted of 159 large galleys and galleons, carrying on board 30,000 forces, janizaries and ſpahis, beſides the ſlaves at the oar, accompanied by a conſiderable number of other veſſels, laden with artillery, ammunition, and other neceſſaries for a ſiege. The whole armament was commanded by Muſtapha Baſha, on old experienced officer, aged about 85 years, and an old favourite and confident of the ſultan; of an haughty cruel temper, who made it a merit to violate his word, and to uſe all manner of violence againſt the Chriſtians, eſpecially againſt the Malteſe. This formidable army landed at ſome diſtance from Il Borgo, and ſoon afterwards ſpread themſeves over the country; ſetting fire to the

11
The ſiege commenced.

villages, putting the peaſants to the ſword, and carrying off ſuch of the cattle, as, notwithſtanding the orders of the grand-maſter, had not been ſecured within the forts and towns.

While the Turks were thus employed, La Valette (the grand maſter) ſent out De Copier, marſhal of the order, with 200 horſe and 600 foot, to watch their motions De Copier, an officer of great experience, executed his commiſſion with ſo much prudence and vigour, that by falling unexpectedly on detatched parties, he cut off 1500 Turks with the loſs only of 80 men.

The Turkiſh general held a council of war as ſoon as all his troops were landed, to aſſiſt him in reſolving where he ſhould begin his attack. Piali, the Turkiſh admiral agreeably to what he underſtood to have been the ſultan's inſtructions, was of opinion that they ought not to enter upon action till Dragut ſhould arrive. But Muſtapha having received information of the king of Spain's preparations, thought ſomething ought to be done inſtantly for the ſafety of the fleet; which lay at preſent in a creek, where it was expoſed to the violence of the eaſt wind, and might be attacked with great advantage by the Spaniards. On this account he was opinion, that they ſhould immediately lay ſiege to a fort called *St Elmo*, which ſtood on a neck of land near Il Borgo, having the principal harbour on one ſide of it, and on the other another harbour large enough to contain the whole fleet in ſafety. This propoſal was approved by a majority of the council, and Muſtapha proceeded without delay to carry it into execution.

12
Deſperate defence of fort St Elmo.

La Valette did not expect that a place which was neither ſtrong nor large enough to admit a numerous garriſon could be defended long againſt ſo great a force as was employed to reduce it; but he thought it neceſſary that the ſiege of this fort ſhould be prolonged as much as poſſible, in order to give the viceroy of Sicily time to come to his relief. With this view, he reſolved to throw himſelf into St Elmo, with a ſelect body of troops; and he was preparing to ſet out, when the whole body of knights remonſtrated with ſuch earneſt importunity againſt his leaving the town, that he at laſt conſented to ſuffer the reinforcement, which he had prepared, to be conducted to the fort by a knight called *De Medran*, upon whoſe conduct and intrepidity he could rely with the moſt aſſured confidence.

Not long after De Medran's arrival in the fort, the garriſon a made vigorous ſally, in which they drove the enemy from their entrenchments, and put a number of them to the ſword. But the reſt ſoon recovered from their ſurpriſe; and having returned to the charge, they compelled the Chriſtians to retire. In this rencounter, the vigorous efforts of the Janiſaries were favoured by the wind, which blew the ſmoke of the guns upon the fort, and covered the beſieged with a thick cloud, through which it was impoſſible to diſcern the operations of the enemy. This incident the Turks had the preſence of mind to improve to very great advantage. They ſeized, unperceived, upon the counterſcarps; made a lodgement there with beams, woolſacks, and gabions; and raiſed a battery upon it with incredible expedition. After the ſmoke was diſperſed, the beſieged beheld what had been done with much aſtoniſhment; and they were the more diſquieted, as the fortification which the Turks had raiſed upon the counterſcarp, overtopped a ravelin which lay near it, in which the beſieged could no longer appear with ſafety. They reſolved, however, to defend this ravelin as long as poſſible, whatever it ſhould coſt them.

In the mean time Dragut, and another noted Corſair named Uluchiali, arrived with 20 galleys; having, beſides ſlaves and ſeamen, 2500 troops on board. This reinforcement, and the preſence of Dragut, added freſh vigour to the operations of the ſiege. This gallant Corſair expoſed himſelf, on all occaſions, with the utmoſt intrepidity; ſpent whole days in the trenches; and beſides his other extraordinary talents, he was particularly ſkilful in the management of artillery, he cauſed ſome new batteries to be raiſed in more advantageous ſituations than had hitherto been made choice of; and kept up a continual fire both on the ravelin abovementioned and a cavalier that covered the fort, and was one of its principal defences.

This cavalier ſoon became the only defence which could prevent the beſiegers from coming up to the very foot of the wall. Some Turkiſh engineers having approached the ravelin at day-break, to obſerve the effects of their artillery, they perceived a gun-port ſo low, that one of them, when mounted on the ſhoulders of another, looked into into it, and ſaw the Chriſtien ſoldiers lying on the ground ſleep. Of this they gave immediate information to the troops; who, advancing as quickly and ſilently as poſſible, and clapping ladders to the gun-hole, got up into the ravelin, and cut moſt of the Chriſtians to pieces.

Between this ravelin and the cavalier lay the ditch, over which the beſiegers had thrown a temporary bridge of planks leading up to the cavalier. The Turks, perceiving this, leaped inſtantly upon the bridge, and attempted to make themſelves maſters of the cavalier, as they already were of the ravelin. But the garriſon was now alarmed; the braveſt of the knights haſtened from different quarters to the poſt of danger; and, after an obſtinate engagement, they compelled the Turks to retire into the ravelin. There, obſerving another way of reaching the cavalier by a path from the bottom of the ditch, they threw themſelves down without dread or heſitation; and having aſcended by this path to the other ſide; they renewed their attack with greater fury than ever. The combat laſted from ſun-riſe till noon, when the knights at laſt proved victorious. About 20 knights and 100 ſoldiers were killed; and near 3000 of the enemy.

As the ravelin was open on the ſide towards the fort, the beſieged pointed ſome cannon againſt it, and made great havock among the infidels. But Muſtapha, ſenſible of the value of the acquiſition he had made, poured in freſh ſoldiers without number, and the pioneers coming forward with wool-ſacks, planks, and gabions, put the troops at length in ſafety, and made a lodgment in the ravelin, of which the garriſon were never afterwards able to diſpoſſeſs them.

The grand-maſter's concern on account of this diſaſter was greatly augmented, by conſidering, that it could not have happened ſo ſoon without ſome negligence on the part of the garriſon. He ſent them, however, an immediate reinforcement, and both the ſiege and the defence were carried on with the ſame vigour as before.

But the ſituation of the beſieged was now become much more dangerous than formerly. The Turks applied with unremitting diligence to heighten the ravelin till it overtopped the wall of the fort; and after this the garriſon could no longer appear upon the parapet with ſafety. Many were killed by the enemy's artillery, ſeveral breaches were made in the wall, and the hearts of the braveſt kights began to fail within them.

13 **The knights deſire permiſſion to leave the fort, but are refuſed.**

They agreed therefore, though with much reluctance, to apply to the grand-maſter for liberty to quit the fort; and they made choice of the chevalier de Medran for their meſſenger. He repreſented that the fort was in reality no longer tenible; and that to continue in it, though only for a few days, would infallibly occaſion the deſtruction of the garriſon.

Moſt of the knights in council thought that this requeſt of the garriſon, ought to be immediately granted. But la Vallette was of a contrary opinion.—This he repreſented to the chevalier de Medran; and ſent him back with inſtructions to remind the knights of the vows which they took at their entrance into the order of ſacrificing their lives for its defence. He likewiſe bad him aſſure them, in his name, that he would not fail to ſend them ſuch reinforcements as they ſhould ſtand in need of: and was determined, as ſoon as it ſhould be neceſſary, to come himſelf to their aſſiſtance, with a fixed unalterable purpoſe to lay down his life ſooner than deliver the fort into the hands of the infidels.

This anſwer had the deſired effect on ſeveral of the knights, and particularly on thoſe whoſe principles of honour and attachment to the order were confirmed by years. But the greater part of them were much diſſatisfied. They thought the grand-maſter's treatment of them harſh and cruel; and wrote him a letter ſubſcribed by 53; in which, after repeating their former requeſt, they informed him, that if he did not, on the next night, ſend boats to carry them to the town, they were determined to ſally out into the Turkiſh camp, where they might fall honourably by the ſword, inſtead of ſuffering ſuch an ignominious death as they had reaſon to expect if the fort was taken by ſtorm.

To this letter la Valette replied, "That they were much miſtaken if they expected to ſatisfy their honour by throwing away their lives: ſince it was no leſs their duty to ſubmit to his authority, than to ſacrifice their lives in defence of the order: that the preſervation of the whole depended on their preſent obedience to his commands: that no aid was to be expected from Spain if the fort were given up. And that if he ſhould yield to their requeſt, and bring them to the town, the town itſelf would then be immediately inveſted; and they, as well as the reſt, ſoon afterwards reduced to a ſituation more deſperate than that from which they were ſo ſolicitous to eſcape, by deſerting an important poſt which they had undertaken to defend." Beſides this leter, he ſent three commiſſioners to examine the ſtate of the fortifications; intending by this meaſure either to gain time or to prevent the garriſon from ſinking into deſpair.

Theſe commiſſioners differed very widely in the accounts which they delivered at their return. Two of them thought it impoſſible to defend the fort much longer. But the third named, Conſtantine Caſtriot, a Greek prince, deſcended from the famous Albanian hero Scanderbeg, whether from ignorance or a conſciouſneſs of greater reſources in his native courage than the other two poſſeſſed, maintained that the garriſon was far from being reduced to the laſt extremity; and to give proof how firmly he was perſuaded of the truth of what he ſaid, he offered to enter the fort himſelf, and to untertake the defence of it with ſuch troops as ſhould be willing to accompany him.

The grand-maſter, ſtrongly impreſſed with a ſenſe of the neceſſity of potracting the ſiege, immediately accepted this offer, and beſtowed the higheſt encomiums on Caſtriot's zeal and reſolution. Nor did Caſtriot find any difficulty in perſuading a ſufficient number to attend him, who were no leſs zealous and reſolute than himſelf. The ſoldiers crowded to his ſtandard, and were emulous to have their names enrolled for that dangerous ſervice in which he had engaged.

When la Valette ſaw the ſpirit by which theſe men were animated, and had no longer any doubt of being able by their means to prolong the ſiege of the fort; he ſent a letter to the knights, acquainting them, that he was now willing to give them their diſcharge, and would immediately ſend another garriſon, into whoſe hands he deſired they ſhould be ready to deliver up the fort, and come themſelves to the town in the boats in which their ſucceſſors were to be tranſported.

The contents and ſtyle of this letter affected the knights in the moſt ſenſible manner; and rouſed within them that delicate ſenſe of honour by which the order had been ſo long and ſo eminently diſtinguiſhed.—They reſolved without heſitation to remain in the fort till every man ſhould periſh, rather than either deliver it to the new garriſon or abandon it to the enemy. And they went in a body to the governor, and intreated him to inform the grand-maſter of their repentance, and to join with them in praying that they might be ſuffered to wipe out the remembrance of their fault by their future conduct.

The grand-maſter ſuffered himſelf at laſt to be overcome: and henceforth the garriſon diſmiſſing all thoughts of their own ſafety, were intent on nothing but how to prolong their defence.

14 **Invention of burning hoops.**

The grand-maſter ſent them every night freſh troops to ſupply the place of the killed and wounded; and kept them well furniſhed with proviſions, ammunition, and fire-works. Of theſe laſt he had invented a particular kind, which conſiſted of hoops of wood, covered with wool, and ſteeped in boiling oil and other inflammable liquors, mixed with nitre and gunpowder. To theſe machines they ſet fire, and threw them flaming in the midſt of the enemy when they were crowded together at an aſſault. It happened often that two or three of the Turks were hooked together and ſcorched to death, and the utmoſt confuſion was produced wherever they were thrown.

The beſieged ſtood much in need of this, and every other inſtrument of miſchief that could be deviſed, for their defence. In ſpite of the moſt vigorous oppoſition, the Turks had caſt a bridge over the ditch, and begun to ſap and undermine the walls. From the 17th of June to the 14th of July, not a ſingle day paſſed without ſome rencounter; and Muſtapha had frequently attempted to ſcale the wall of the fort, but had been as often repulſed with the loſs of ſome of the braveſt of his troops.

Aſhamed at having been detained ſo long before a place of ſuch inconſiderable ſtrength, he reſolved to make one great deciſive effort; and to bring to the aſſault as many of his forces as the ſituation of the place would permit him to employ. He had already made ſeveral breaches; but in order to ſecure the ſucceſs of the aſſault which he now intended, he kept his batteries playing all the 15th without intermiſſion, till the wall on that ſide where he deſigned his attack was almoſt level with the rock. On the 16th, the fleet was drawn up before ſunriſe, as near the fort as the depth of the water would allow. Four thouſand muſketeers and arches were ſtationed in the trenches; and the reſt of the troops, upon a ſignal given, advanced to the breach. The garriſon was prepared to receive them; the breach was lined with ſeveral ranks of ſoldiers, having the knights interſperſed among them at certain diſtances. The Turks attempted often to break through this determined band, and to overpower them with their numbers; but their numbers ſerved only to augment the loſs which they ſuſtained. Every ſhot from the fort did execution. The artillery made dreadful havoc among them; and the burning hoops were employed with aſtoniſhing ſucceſs. The novelty of theſe machines, and the ſhrieks of thoſe who were caught in them, added greatly to the terror which they inſpired; and made it impoſſible for the Turkiſh officers to keep their men firm and ſteady in purſuing the advantages which, had they preſerved their ranks, their numbers muſt have infallibly acquired.

At length Muſtapha, after having continued the aſſault for more than ſix hours, without gaining a ſingle inch of ground on the beſieged, gave orders for ſounding a retreat. In this attack the garriſon loſt about 20 knights and 300 ſoldiers; but this loſs was immediately ſupplied by a reinforcement from the town; and Muſtapha was at laſt convinced, that, unleſs the communication between the fort and the town were cut off, it would be impoſſible to bring the ſiege of the former to a period, while any troops remained in the other parts of the iſland. By the advice of Dragut, he reſolved to extend his trenches and batteries on the ſide next the town, till they ſhould reach to that part of the ſea, or great harbour, where thoſe ſupplies were landed which the grand-maſter daily ſent to the garriſon. This undertaking he knew muſt be attended with the utmoſt difficulty, becauſe all the ſpace between his entrenchments, and the point to which it was neceſſary to extend them, lay expoſed to the artillery both of fort St Elmo and St Angelo. In viewing the ground, a Sangiac, in whom he put confidence, was killed by his ſide; and which was ſtill a more irreparable loſs, Dragut received a mortal wound, of which he died in a few days. This did not, however, diſcourage Muſtapha from purſuing his deſign. By employing his troops and pioneers at the work day and night without intermiſſion, he at length carried it into execution. Then having planted batteries along the ſhore, and filled his trenches with muſketeers, it was impoſſible for any boat to paſs from the town to the fort without the moſt eminent danger of either being ſunk or intercepted.

After this precaution he reſumed with freſh vigour his attempts to take the fort by ſtorm. On the 21ſt he made four different aſſaults: all of which the garriſon withſtood; and, in repulſing ſo many thouſand brave and well-diſciplined troops, diſplayed a degree of proweſs and fortitude which almoſt exceeds belief, and is beyond the power of deſcription. But this heroic garriſon was now exceedingly reduced in number; and there was the ſtongeſt reaſon to apprehend, that, in one aſſault more, they muſt inevitably be overpowered, unleſs a reinforcement were ſent them from the town. Of their deſperate ſituation they gave intelligence to the grand-maſter by one who ſwam acroſs the harbour in the night. The boats were inſtantly filled with knights and other ſoldiers, who generouſly reſolved to devote themſelves to certain deſtruction for the general ſafety, and the preſervation of the fort. They ſet off from the town with as much alacrity as if they had entertained the moſt ſanguine hopes of victory; but they found the Turks every where ſo much upon their guards, and the lines ſo ſtrongly defended, that, after ſeveral fruitleſs attempts to land, they were at laſt obliged to return, depreſſed with ſorrow for the fate of their brave companions.

The garriſon, now deſpairing of relief, gave themſelves up for loſt; but inſtead of either capitulating or attempting to eſcape, they prepared for death, and paſſed the night in prayer and in receiving the ſacrament; after which they embraced one another tenderly, and then repaired to their reſpective poſts; while ſuch of the wounded as had been diſabled from walking, were, at their own earneſt deſire, carried to the ſide of the breach, where they waited, without diſmay, for the approach of the Turkiſh army.

Early in the morning of the 23d of July, the Turks advanced to the aſſault with loud ſhouts, as to certain victory, which they believed ſo ſmall a handful of men as now remained in the fort would not dare to diſpute with them. In this expectation they were diſappointed. The garriſon being reſolved on death, and deſpiſing danger, were more than men; and exerted a degree of proweſs and valour that filled their enemies with amazement. The combat laſted upwards of four hours, till not only every knight but every ſoldier had fallen, except two or three who had ſaved themſelves by ſwimming. The Turkiſh colours were then planted on the ramparts; and the fleet entered the harbour, which the fort commanded, in a kind of triumph. When Muſtapha took a view of the fort, and examined its ſize and fortifications, he could not refrain from ſaying, "What will not the father coſt us (meaning the town), when the ſon, who is ſo ſmall, has coſt ſo many thouſands of our braveſt troops?" But this reflection, far from exciting his admiration of that heroic fortitude which he had found ſo difficult to overcome, ſerved only to inſpire him with a brutal fury. He ordered all ſuch of the garriſon as were found lying on the breach alive to be ript open, and their

15
The fort taken, and the garriſon cut off,

16
Cruelty of Muſtapha.

hearts torn out: and, as an inſult on the knights and their religion, he cauſed their dead bodies to be ſearched for, and large gaſhes to be made in them, in the form of a croſs; after which he tied them on planks, and threw them into the ſea, to be carried by the wind and tide to the town or fort St Angelo.

17 And of the grand maſter,

The grand-maſter was at firſt melted into tears at this ſhocking ſpectacle; but his grief was ſoon converted into indignation and revenge: and theſe paſſions betrayed him into an action unworthy of the exalted character which he bore. In order to teach the baſha, as he pretended, to make war with leſs barbarity, he cauſed all the Turks whom he had taken priſoners to be maſſacred; and then putting their heads into his largeſt cannon, he ſhot them into the Turkiſh camp.

In the ſiege which has been related, the order loſt about 1500 men, including 130 of the braveſt knights.

Muſtapha vainly imagined, that, being intimidated by the fate of their companions, they would be now inclined to liſten to terms of capitulation; and in this hope, he ſent an officer with a white flag to one of the gates, attended by a Chriſtian ſlave deſigned to ſerve for his interpreter. The Turk was not allowed to enter within the town; but the Chriſtian was admitted and was led through ſeveral ranks of ſoldiers under arms by an officer, who, after ſhowing him all the fortifications of the place, deſired him to take particular notice of the depth and breadth of the ditch, and ſaid to him, “ See there, the only ſpot we can afford your general; and there we hope ſoon to bury him and all his Janiſaries.”

This inſulting ſpeech being reported by the ſlave, excited in the fiery mind of the baſha the higheſt degree of wrath and indignation, and made him reſolve to exert himſelf to the utmoſt in the proſecution of the ſiege. His troops though greatly diminiſhed, were ſtill ſufficient to inveſt at once both the town and the fort of St Michael. He kept a conſtant fire on both; but he intended firſt to apply to the reduction of the latter, which he propoſed to attack both by land and water, at the extremity of the peninſula on which it ſtands. In order to accompliſh this deſign, it was neceſſary he ſhould have ſome ſhipping introduced into the harbour for tranſporting his forces. But the mouth of the harbour having been rendered inacceſſible by a great iron chain and the cannon of St Angelo, his deſign muſt have been relinquiſhed, if Piali had not ſuggeſted an expedient againſt which the grand-maſter had not provided. This was, to make the Chriſtian ſlaves and crews of the ſhips draw a number of boats, by the ſtrength of their arms, over the neck of land on which ſtood fort St Elmo. Of this propoſal, which Muſtapha immediately adopted, information was carried to the grand-maſter by a Turkiſh officer; who, being by birth a Greek, was touched ſuddenly with remorſe, and deſerted to the Chriſtians. In conſequence of this intelligence, La Valette ſet a great number of hands to work in framing a ſtacado along that part of the promontory where the Turks intended their attack; and at another part, where the depth of the water or the hardneſs of the bottom would not admit the ſtacado, he cauſed ſtrong intrenchments to be made upon the beach. Muſtapha, in the mean time, fired inceſſantly upon the fort, while the ſlaves and crews were employed in tranſporting the boats over land into the harbour. At length the baſha, judging that the number of boats which he had tranſported would be ſufficient, and that the breaches which his artillery had made were practicable, reſolved without further delay, to make an attack both by ſea and land. He was the more confident of ſucceſs, as ſince the taking of St Elmo, he had received a conſiderable reinforcement. By the arrival of Haſcem, ſon of Barbaroſſa, with 2500 ſelect ſoldiers, commonly called *the Bravoes of Algiers*. Haſcem, who poſſeſſed a conſiderable ſhare of his father's fire, and was ambitious to diſtinguiſh himſelf in the ſultan's ſervice, begged of Muſtapha to intruſt him with the aſſault of fort St Michael; and vaunted, with his natural arrogance, that he would ſoon make himſelf maſter of it ſword-in-hand. The baſha, whether from an opinion of his valour, or an intention to make him learn at his own expence the folly of his preſumption, readily complied with his requeſt; and, having added 6000 men to his Algerines, he promiſed to ſupport him with the reſt of his army.

Haſcem divided his forces with Candeliſſa, an old corſair, his lieutenant; to whom he committed the attack by ſea, whilſt he reſerved that on the land-ſide to himſelf.

18 The Turks repulſed with great ſlaughter.

Candeliſſa having put his troops on board of the boats, ſet out with drums beating, and hautboys and other muſical inſtruments playing, preceded by a boat filled with Mahometan prieſts, ſome of whom were employed in offering prayers to heaven for his ſucceſs, or in ſinging hymns; while others had books in their hands, out of which they read imprecations againſt the Chriſtians. Candeliſſa attempted firſt to break down the ſtacado which had been formed to obſtruct his landing; but finding it much ſtronger than he expected, and that, while he was employed in demoliſhing it, his troops muſt ſuffer greatly from the enemy's fire, he thought it would be eaſier to make a deſcent on that part of the ſhore which the grand-maſter had ſtrengthened with entrenchments. At this important poſt, the Chriſtian troops were commanded by an ancient knight of the name of *Guimeran*. This experienced officer reſerved his fire till the Turks had advanced within a little diſtance of the ſhore, when, by a ſingle diſcharge, he killed about 400 men. This did not prevent the reſt from approaching. Candeliſſa puſhed forward while the Chriſtians were loading their canons, and landed at the head of his Algerines. But Guimeran having reſerved ſome cannon charged with grape-ſhot, did dreadful execution among them after they had landed, and many of them began to fly to their boats: which Candeliſſa obſerving, he commanded the boats to be put off a little diſtance from the ſhore. His troops, perceiving then that they muſt either die or conquer, took courage from deſpair, and advanced boldly to the intrenchment, with ladders for ſcaling it in one hand and their ſabres in the other. The combatants on both ſides diſplayed the moſt intrepid valour. Great numbers fell, and the ditch was choaked with blood, and with the bodies of the dead and wounded. The Turks at laſt, after an engagement of five hours, reached the top of the entrenchment,

ment, and there planted their enſigns. The knights, ſtung with ſhame on account of their retreat, returned with redoubled ardour. But they would probably have been overpowered by the ſuperior number of the enemy, had not the grand-maſter ſent them a ſeaſonable reinforcement, under the admiral de Giou and the chevalier de Quiney; who fell upon the Algerines and Turks with a degree of fury that ſtruck terror into Candeliſſa himſelf, who was noted for his intrepidity. Having ordered the boats to be brought nearer the ſhore he was among the firſt who fled. His bravoes fought deſperately for ſome time after he had left them; but were at length thrown down from the intrenchments, and compelled to fly to their boats with the utmoſt precipitation. The Chriſtians purſued them and the batteries continued firing on them without intermiſſion. Many of the boats were ſunk; the water was covered with dead bodies, mangled limbs, ſhields, and helmets. Of the 4000 who had been ſent on this enterpriſe ſcarcely 500 remained, and many of theſe were dangerouſly wounded.

Haſcem was not more fortunate in his aſſault by land than Candeliſſa was by ſea. After having been repulſed at one breach with great ſlaughter, he rallied his troops, and led them on to another, where he fought long and deſperately, till moſt of the bravoes having fallen by his ſide, he was obliged, with much reluctance and ſorrow to ſound a retreat.

19
Incredible valour of the Malteſe.

Muſtapha, not unmindful of his promiſe to ſupport him, no ſooner perceived him beginning to retire, than he ordered the Janiſaries, whom he kept under arms to advance. The garriſon had maintained an engagement with Haſcem for five hours, in the middle of the day, and in the hotteſt ſeaſon of the year; yet, as if they had not been ſubject to the wants and weakneſſes of humanity, they advanced beyond the breach to meet the Janiſaries, and fought apparently with as much vigour and fortitude as before. By the power of ſuperior numbers, they were compelled to fall back within the breach. But there they made the moſt deſperate reſiſtance; and, being reinforced by De Giou and De Quiney, with the troops which had triumphed over Candeliſſa, they at laſt repulſed the Janiſares with dreadful ſlaughter; after having loſt more than 40 knights, and 200 of the braveſt of the common men.

Muſtapha, enraged by this invincible obſtinacy which the Chriſtians diſplayed in their defence, and dreading that the Spaniſh ſuccours which had been already delayed much longer than he expected, might ſoon arrive, reſolved now to employ his whole force at once; and while he himſelf proſecuted the ſiege of fort St Michæl with one half of his troops to employ the other, under Piali, againſt the town. More batteries were raiſed; the trenches were advanced ſtill nearer than before; bridges of ſail-yards and maſts were thrown over the ditches; mines, notwithſtanding the hard and rocky ſoil, were ſprung; aſſaults were repeated without number; and the two baſhas, emulous of one another, and each of them agitated with continual anxiety leſt victory ſhould declare firſt for his competitor, exhibited the moſt ſhining proofs of perſonal courage, and exhauſted all the art of war then known in the world. Yet through the determined bravery of the knights, conducted by the grand-maſter with conſummate prudence and indefatigable vigilance, the Turks were baffled in every attempt, and repulſed with ſlaugher. Muſtapha flattered himſelf once with the moſt ſanguine hopes of ſucceſs on his part, from a machine invented by his principal engineer, in the form of a huge caſk, bound ſtrongly with iron hoops, and filled with gunpowder, nails, chains bullets, and ſuch other inſtruments of death. After ſetting fire to a train which was faſtened to this machine, it was thrown, by the force of an engine, upon a ravelin that was the principal defence of the fort. But the garriſon, undiſmayed, found means before it caught fire, to caſt it out again into the midſt of the aſſailants. In a moment afterwards it burſt with dreadful fury and filled the Turks with conſternation. The knights then ſallied upon them ſword-in-hand; and taking advantage of their confuſion, killed many of them, and put the reſt to flight.

20
A great number of Turks deſtroyed by a contrivance of their own.

Piali had, on ſome occaſion, ſtill more reaſon than Muſtapha to entertain the hopes of victory, although the town was much ſtronger than the fort and La Valette commanded there in perſon. By his batteries he had demoliſhed all the out-works of the place, and had made an immenſe breach in the wall. While his troops were engaged in a furious aſſault, that engroſſed the whole attention of the beſieged from morning till night, he employed a great number of pioneers in raiſing a cavalier or platform of earth and ſtones, cloſe by the breach, and ſo high as to overlook the parapet. Night, in the mean time came on, and prevented him from carrying any further this great advantage; but he doubted not that the next day he ſhould be able to make himſelf maſter of the place.

21
The grand-maſter prevents the knights from abandoning the town.

As ſoon as he had drawn off his forces, a council of the order was convened, and moſt of the knights were of opinion that the town was no longer tenible; that the fortifications which ſtill remained ſhould be blown up; and that the garriſon and inhabitants ſhould retire into the caſtle of St Angelo. But the grand-maſter received this propoſal with horror and indignation. “This would be in effect (ſaid he) to deliver the whole iſland into the hands of the infidels. Fort St Michael, which has been ſo gallantly defended, and which is preſerved by its communication with the town would thus be ſoon reduced to the neceſſity of ſurrendering. There is no room in the caſtle of St Angelo, for the inhabitants and troops; nor, if there were room, is there water in that fort for ſo great a number.” It was then propoſed, that at leaſt the relics of the ſaints and the ornaments of the churches ſhould be carried into the caſtle; and the knights earneſtly intreated the grand-maſter to retire into it himſelf, aſſuring him that they would conduct the defence with the utmoſt vigour and viligance. “No, my brethren (he replied), what you propoſe as to the ſacred things would ſerve only to intimidate the ſoldiers. We muſt conceal our apprehenſions. It is here we muſt either die or conquer. And is it poſſible that I, at the age of 71, can end my life ſo honourably as in fighting, together with my friends and brethren, againſt the implacable enemies of our holy faith? He then told them what he thought proper to be done, and proceeded inſtantly to be put into execution. Having called all the ſoldiers from fort St Angelo, except a few who were neceſſary for managing the artillery, he employed them

them and the inhabitants all night in throwing up intrenchments within the breach; after which he ſent out ſome of the braveſt knights, with a ſelect body of troops, to make an attempt on the cavalier. Theſe men ſtole ſoftly along the foot of the wall till they arrived at the place appointed; when they ſet up a loud ſhout, and attacked the guards whom Piali had left there with ſo much fury, that the Turks, believing the whole garriſon had fallen upon them, abandoned their poſt, and fled precipitately to their camp.

The cavalier was immediately fortified, a battery of cannon planted on it, and a parapet raiſed on the ſide towards the enemy. And thus the breach was rendered impracticable; the town put in greater ſecurity than before; and a work, which had been deviſed for its deſtruction, converted into a bulwark for its defence.

The grand-maſter had now greater confidence than ever of being able to hold out till the Spaniards ſhould come to his relief. In conſequence of the aſſurances given by Philip and the Sicilian viceroy, he had, long before this time, entertained the hopes of their arrival; and had often earneſtly ſolicited the viceroy to haſten his departure from Meſſina. The conduct of this nobleman was long exceedingly myſterious. The patience of the knights was worn out by his delays; and they, and many others, ſuſpected that the real motive of his conduct was the dread of encountering with an admiral of ſo conſiderable reputation as Piali. But it afterwards appeared that the viceroy had acted agreeably to his inſtructions from the court of Spain. For although Philip was, for the reaſons abovementioned, ſincerely intereſted in the preſervation of the knights, and had amuſed them with the moſt flattering promiſes of aſſiſtance; yet he ſeems from the firſt to have reſolved not to expoſe himſelf to danger on that account, and to avoid if poſſible a general engagement.

22
Ungrateful and ungenerous conduct of the king of Spain.

A generous and grateful prince would have acted very differently towards an ally ſo deſerving of his ſupport; and if either generoſity or gratitude had been the leading principle of Philip's conduct, it is probable he would, on this occaſion, have regarded the knights as his own ſubjects; and have thought it no leſs incumbent on him to exert himſelf in their defence, than if they had acknowledged him as their ſovereign.

But Philip was affected by their danger only ſo far as it threatened the tranquillity of his own dominions. He had reſolved to interpoſe in their behalf, rather than to ſuffer them to be overpowered; but he appears to have been very little touched with their calamities, and to have intended to leave them to themſelves, as long as there was any proſpect of their being able to make reſiſtance; by doing which he conſidered, that he would not only preſerve his own ſtrength entire, but might afterwards engage with the Turks when they were exhauſted by the operations of the ſiege.

Philip adhered inflexibly to this plan, notwithſtanding the grand-maſter's repeated importunities, much longer than was conſiſtent with his own ſelfiſh views. For, without a degree of fortitude and proweſs on the part of the garriſon, and a degree of wiſdom, vigilance, and magnanimity on that of the grand-maſter, infinitely higher than there could be reaſon to expect, it muſt have been impoſſible for ſuch a handful of men to have withſtood, for ſo long a time, ſo great a force, and ſuch mighty efforts, as were employed to reduce them. Even the death of the grand-maſter alone, whoſe perſon was expoſed to perpetual danger, would have proved fatal to the knights, long before Philip ſent orders to his viceroy to give them any effectual ſupport; and in this caſe, as his own dominions or his fleet would have been immediately attacked, he would probably have had little reaſon to be ſatisfied with the timid ungenerous counſels which he purſued.

Whatever judgment may be formed on this head, the viceroy did not think himſelf at liberty to yield to the repeated applications of the grand-maſter, till the operations of the ſiege began to relax, and the Turkiſh forces were reduced from 45,000 to 15,000 or 16,000; of whom many were worn out with the fatigues which they had undergone, and others rendered unfit for action by a bloody-flux, which for ſeveral weeks had raged amongſt them.

In this ſituation of affairs, when it was probable that the knights would, without aſſiſtance, have compelled the Turks to raiſe the ſiege, the viceroy let the grand maſter know, that he had now received ſuch inſtructions from the king, as put it in his power to ſhow his attachment to the order: that he was not indeed permitted to attack the Turkiſh fleet; but that he would immediately bring him a ſtrong body of troops, whoſe commanders (as he himſelf muſt return to Sicily) were to be entirely ſubject to the grand-maſter's authority till the enemy ſhould be expelled.

23
The knights receive a reinforcement.

The viceroy, altho' ſtill ſuſpected of interpoſing unneceſſary delays, at length fulfilled his promiſe; and on the 7th of September landed 6000 men, under Don Alvaro de Sandé and Aſcanio della Corna, in that part of the iſland which lay at the greateſt diſtance from the Turks; after which, he immediately carried back the fleet to Sicily.

In the mean time, intelligence being brought to Muſtapha that the Spaniards were landed, and marching towards him, he was thrown into the moſt dreadful conſternation. Senſible that his ſoldiers were much diſheartened by their ill ſucceſs, he imagined that he was about to be attacked by a ſuperior army, conſiſting of the braveſt and beſt diſciplined troops in Spain. Without waiting for information of their number, he forewith raiſed the ſiege, drew his garriſon out of St Elmo, and leaving all his heavy cannon behind him, embarked his troops with as much precipitation as if the Spaniards with ſuperior forces had been in ſight. He had ſcarcely got on board when a deſerter arrived from the Spaniſh camp, and informed him, that with 15,000 or 16,000 men, he had fled before an army that did not exceed 6000, having no general at their head, and commanded by officers who were independent of one another. The baſha was overwhelmed with ſhame and vexation by this intelligence, and would have immediately diſembarked; but this, he knew, he durſt not attempt without conſulting Piali, Haſcem, and his other principal officers.

24
The Turks raiſe the ſiege in a panic.

While he was deliberating upo nit, he grand-maſter improved to the beſt advantage the leiſure that was afforded him. He employed all the inhabitants, men, women, and children, as well as the ſoldiers, filling up the enemy's trenches, and demoliſhing their works; and put a garriſon without delay into fort St Elmo; in which the Turks now beheld from their ſhips the ſtandard of St John erected, where that of Mahomet had lately ſtood.

This demonſtrated to Muſtapha how much new labour awaited him in caſe he ſhould return to the ſiege; but being enraged againſt himſelf on account of the precipitancy of his retreat, and diſquieted at the thoughts of the reception which he had reaſon to expect from Solyman, he wiſhed to atone for his imprudence, and to wipe off the reproach in which it had involved him, by victory or death. Piali, who, from his jealouſy of the baſha's credit with the ſultan, was not ſorry for the failure of his enterpriſe, repreſented in a council of war convened on this occaſion, That as the troops were much diſpirited and worn out, it would be expoſing them to certain deſtruction, either to lead them againſt the enemy, or to reſume the operations of the ſiege. But a majority of the council were of a different opinion; and it was reſolved to land the forces again without delay.

25 They return, but are defeated.

The Turkiſh ſoldiers complained bitterly of this unexpected reſolution, and obeyed the orders to diſembark with the greateſt reluctance. Their officers were obliged to employ threats with ſome and force with others. At length the number intended was put on ſhore, and Muſtapha ſet out at their head in ſearch of the enemy.

The grand-maſter had not neglected to give early notice of their march to the Spaniſh commanders, who had entrenched their little army on a ſteep hill, which the Turks would have found almoſt inacceſſible; and it was the opinion of ſome of the principal officers, that they ſhould avail themſelves of the advantage of their ſituation, and ſtand on their defence. But this propoſal was rejected with diſdain by the bold adventurous De Sande, and the greateſt part of the Spaniſh officers; and the troops were led out of their encampment, to meet the enemy in the open field. This conduct, more fortunate perhaps than prudent, contributed to increaſe the dejection of the Turkiſh ſoldiers, and to facilitate their defeat. Having been dragged againſt their inclination to the field of battle, and being attacked by the Spaniards with great fury, both in front and flank, they ſcarcely fought, but, being ſtruck with a ſudden panic, fled with the utmoſt precipitation.

Muſtapha, confounded and enraged by this puſillanimous behaviour of his troops, was hurried along by the violent tide of the fugitives. He fell twice from his horſe, and would have been taken priſoner if his officers had not reſcued him. The Spaniards purſued briſkly till they came to the ſea-ſhore. There Piali had his boats ready to receive the Turks, and a number of ſhallops filled with muſketeers drawn up to favour their eſcape. Without this precaution, they muſt all have periſhed; and, even notwithſtanding the protection which it afforded them, the number of their killed amounted to 2000 men, while the victors loſt only 13 or 14 at moſt.

Such, after four months continuance, was the concluſion of the ſiege of Malta, which will be for ever memorable on account of that extraordinary diſplay of the moſt generous and heroic valour by which the knights, ſo few in number, were enabled to baffle the moſt vigorous efforts which could be made to ſubdue them by the moſt powerful monarch in the world. The news of their deliverance gave univerſal joy to the Chriſtian powers; and the name of the grand-maſter excited every where the higheſt admiration and applauſe. Congratulations were ſent him from every quarter; and in many ſtates public rejoicings were celebrated on account of his ſucceſs.

With this ſiege is concluded every thing of importance in the hiſtory of Malta. The power of the Turks began about this time to be ſo much circumſcribed, that they ceaſed to be formidable to the Chriſtian nations, and the knights of Malta had no longer an opportunity of exerting their valour as formerly. They have remained ever ſince in quiet poſſeſſion of their iſland, of which the beſt deſcription we have met with is that given by Mr Brydone.

26 Deſcription of the Iſland, &c.

“ The approach of the iſland (ſays he) is very fine, although the ſhore is rather low and rocky. It is everywhere made inacceſſible to an enemy by an infinite number of fortifications. The rock, in many places, has been ſloped into the form of a glacis, with ſtrong parapets and entrenchments running behind it.—On getting aſhore we found ourſelves in a new world indeed.—The ſtreets (of Valetta) crowded with well-dreſſed people, who have all the appearance of health and affluence; and we were conducted by the Engliſh conſul to an inn, which had more the appearance of a palace.

“ After dinner we went to viſit the principal villas of the iſland; particularly thoſe of the grand-maſter and the general of the galleys, which lie contiguous to one another. Theſe are nothing great or magnificent; but they are admirably contrived for a hot climate, where, of all things, ſhade is the moſt deſirable. The orange-groves are indeed very fine, and the fruit they bear ſuperior to any thing of the kind in Spain or Portugal.

“ The aſpect of the country is far from being pleaſing: the whole iſland is a great rock of very white free-ſtone; and the ſoil that covers this rock is, in moſt places, not more than five or ſix inches deep; yet, what is ſingular, we found their crop in general was exceedingly abundant. They account for it from the copious dews that fall during the ſpring and ſummer months; and pretend likewiſe that there is a moiſture in the rock below the ſoil, that is of great advantage to the corn and cotton, keeping its roots perpetually moiſt and cool: without which ſingular quality, they ſay, they could have no crop at all, the heat of the ſun being ſo exceedingly violent.—The whole iſland produces corn only ſufficient to ſupply its inhabitants for five months or little more; but the crop they moſt depend upon is the cotton. They begin to ſow it about the middle of May, and continue till the middle of June; and the time of reaping is in the month of October and beginning of November.

“ They pretend that the cotton produced from this plant, which is ſown and reaped in four months, is of a much ſuperior quality to that of the cotton-tree. I compared them; but I cannot ſay I found it ſo: this is indeed the fineſt; but that of the cotton-tree is by much the ſtrongeſt texture. The plant riſes to the height of a foot and an half; and is covered with a number of nuts or pods full of cotton: Theſe, when ripe, they are at great pains to cut off every morning before ſun-riſe; for the heat of the ſun immediately turns the cotton yellow; which indeed we ſaw from thoſe pods they ſave for ſeed.

“They manufacture their cotton into a great variety of ſtuffs. Their ſtockings are exceedingly fine. Some of them, they aſſured us, had been ſold for ten ſequins a-pair. Their coverlets and blankets are eſteemed all over Europe. Of theſe the principal manufactures are eſtabliſhed in the little iſland of Gozzo, where the people are ſaid to be more induſtrious than thoſe of Malta, as they are more excluded from the world, and have fewer inducements to idleneſs. Here the ſugar-cane is ſtill cultivated with ſucceſs, though not in any conſiderable quantity.

“The Malteſe oranges certainly deſerve the character they have of being the fineſt in the world. The ſeaſon continues for upwards of ſeven months, from November till the middle of June; during which time thoſe beautiful trees are always covered with abundance of of delicious fruit. Many of them are of the red kind, much ſuperior, in my opinion, to the others, which are rather too luſcious. They are produced, I am told, from the common orange-bud, ingrafted on the pomegranate ſtock. The juice of this fruit is as red as blood, and of a fine flavour. The greateſt part of their crop is ſent in preſents to the different courts of Europe, and to the relations of the chevaliers.

The induſtry of the Malteſe in cultivating their little iſland is inconceiveable. There is not an inch of ground loſt in any part of it; and where there was not ſoil enough, they have brought over ſhips and boats loaded with it from Sicily, where there is plenty, and to ſpare. The whole iſland is full of incloſures of free-ſtone, which give the country a very uncouth and barren aſpect; and in ſummer reflects ſuch a light and heat, that it is exceedingly diſagreeable and offenſive to the eyes. The incloſures are very ſmall and irregular, according to the inclination of the ground. This, they ſay, they are obliged to obſerve, notwithſtanding the deformity it occaſions; otherwiſe the floods, to which they are ſubject, would ſoon carry off their ſoil.

“The iſland is covered over with country-houſes and villages, beſides ſeven cities, for ſo they term them; but there are only two, the Valetta, and Citta Vecchia, that by any means deſerve that appellation. Every little village has a noble church, elegantly finiſhed, and adorned with ſtatues of marble: rich tapeſtry, and a large quantity of ſilver-plate.

“The city of Valetta has certainly the happieſt ſituation that can be imagined. It ſtands upon a peninſula between two of the fineſt ports in the world, which are defended by almoſt impregnable fortifications. That on the ſouth ſide of the city is the largeſt. It runs about two miles into the heart of the iſland; and is ſo very deep, and ſurrounded by ſuch high grounds and fortifications, that they aſſured us the largeſt ſhips of war might ride here in the moſt ſtormy weather, almoſt without a cable.

“This beautiful baſon is divided into five diſtinct harbours, all equally ſafe, and each capable of containing an immenſe number of ſhipping. The mouth of the harbour is ſcarcely a quarter of a mile broad, and is commanded on each ſide by batteries that would tear the ſtrongeſt ſhip to pieces before ſhe could enter. Beſide this, it is fronted by a quadruple battery, one above the other, the largeſt of which is a *fleur d'eau*, or on a level with the water. Theſe are mounted with about 80 of their heavieſt artillery; ſo that this harbour, I think, may really be conſidered as impregnable; and indeed the Turks have ever found it ſo, and I believe ever will.

“The harbour on the north ſide of the city, although they only uſe it for fiſhing, and as a place of quarantine, would, in any other part of the world, be conſidered as ineſtimable. It is likewiſe defended by very ſtrong works; and in the centre of the baſon is an iſland on which they have built a caſtle and a lazaret.

“The fortifications of Malta are indeed a moſt ſtupendous work. All the boaſted catacombs of Rome and Naples are a trifle to the immenſe excavations that have been made in this little iſland. The ditches of a vaſt ſize, are all cut out of the ſolid rock. Theſe extend for a great many miles, and raiſe our aſtoniſhment to think that ſo ſmall a ſtate has ever been able to make them.

“One ſide of the iſland is ſo completely fortified by nature, that there was nothing left for art. The rock is of a great height, and abſolutely perpendicular from the ſea for ſeveral miles. It is very ſingular, that on this ſide there are ſtill the veſtiges of ſeveral ancient roads, with the tracks of carriages worn deep in the rocks. Theſe roads are now terminated by the precipice, with the ſeas beneath; and ſhow, to a demonſtration, that this iſland has formerly been of a much larger ſize than it is at preſent; but the convulſion that occaſioned its diminution is probably much beyond the reach of any hiſtory or tradition. It has been often obſerved, notwithſtanding the very great diſtance of mount Ætna, that this iſland has generally been more or leſs affected by its eruptions; and they think it probable, that on ſome of theſe occaſions a great part of it may have been ſhaken into the ſea.

“One half of mount Ætna is clearly diſcovered from Malta. They reckon the diſtance near 200 Italian miles. And the people of Malta affirm, that, in great eruptions of the mountain, their whole iſland is illuminated, and from the reflection in the water there appears a great track of fire all the way from Malta to Sicily. The thundering of the mountain is likewiſe diſtinctly heard.

“We made an expedition through the iſland in coaches drawn by one mule each; the only kind of vehicle the iſland affords. The catacombs, not far from the ancient city of Malta, are a great work; they are ſaid to extend for 15 miles under ground. Many propit, they aſſure us, have been loſt in them by advancing too far; the prodigious number of branches making it next to impoſſible to find the way out again. The great ſource of water that ſupplies the city of Valetta takes its riſe near to this place; and there is an aqueduct compoſed of ſome thouſand arches, that conveys it from thence to the city. The whole of this immenſe work was finiſhed at the private expence of one of the grand-maſters.

“Not far from the old city there is a ſmall church dedicated to St Paul; and juſt by the church a miraculous ſtatue of the ſaint, with a viper on his hand; ſuppoſed to be placed on the very ſpot where the houſe ſtood in which he was received after his ſhipwreck on the iſland and where he ſhook the viper off his hand into the fire without being hurt by it; at which time the Malteſe aſſure, us, the ſaint curſed all the venemous animals of the iſland, and baniſhed them for ever. Whether this be the cauſe of it or not, the fact is certain that there are no venomous animals in Malta. They aſſured us, that vipers had been brought from Sicily, and died almoſt immediately on their arrival.

" Adjoining to the church is the celebrated grotto in which the ſaint was impriſoned. It is looked upon with the utmoſt reverence and veneration: and if the ſtories they tell of it be true, it is well entitled to it all. It is exceedingly damp, and produces (I believe by a kind of petrifaction from the water) a whitiſh kind of ſtone, which, they aſſure us, when reduced to powder, is a ſovereign remedy in many diſeaſes, and ſaves the lives of thouſands every year. There is not a houſe in the iſland that is not provided with it; and they tell us there are many boxes of it ſent annually, not only to Sicily and Italy, but likewiſe to the Levant, and to the Eaſt Indies; and (what is conſidered as a daily ſtanding miracle) notwithſtanding this perpetual conſumption, it has never been exhauſted, nor even ſenſibly diminiſhed; the ſaint always taking care to ſupply them with a freſh quantity the day following. I taſted ſome of it, and believe it is a very harmleſs thing. It taſtes like exceeding bad magneſia, and, I believe, has pretty much the ſame effects. They give about a teaſpoonful of it to children in the ſmall-pox and in fevers. It produces a copious ſweat about an hour after, and, they ſay, never fails to be of ſervice. It is likewiſe eſteemed a certain remedy againſt the bite of all venomous animals. There is a very fine ſtatue of St Paul, in the middle of this grotto, to which they aſcribe great powers.

" The grand-maſter of the knights of Malta is more abſolute, and poſſeſſes more power than moſt ſovereign princes. His titles are, *ſerene highneſs* and *eminence;* and his houſehold attendance and court are all very princely. As he has the diſpoſal of all lucrative offices, he makes of his councils what he pleaſes; beſides, in all the councils that compoſe the juriſdiction of this little nation, he himſelf preſides, and has two votes. He has the diſpoſal of 21 commanderies, and one priory, every five years; and as there is always a number of expectants, he is very much courted. He is choſen by a committee of 21; which committee is nominated by the ſeven nations, three out of each nation. The election muſt be over within three days of the death of the former grand-maſter; and, during theſe three days, there is ſcarce a ſoul that ſleeps at Malta: all is cabal and intrigue; and moſt of the knights are maſked, to prevent their particular attachments and connections from being known: the moment the election is over, every thing returns to its former channel.

" The land-force of Malta is equal to the number of men in the iſland fit to bear arms. They have about 500 regulars belonging to the ſhips of war; and 150 compoſe the guard of the prince. The two iſlands of Malta and Gozzo contain about 150,000 inhabitants. The men are exceedingly robuſt and hardy. I have ſeen them row for 10 or 12 hours without intermiſſion, and without even appearing to be fatigued. Their ſea force conſiſts of 4 gallies, 3 galliots, 4 ſhips of 60 guns, and a frigate of 36, beſides a number of the quick-ſailing little veſſels called *ſcampavias,* (literally *runaways*). Their ſhips, galleys, and fortifications, are not only well ſupplied with excellent artillery, but they have likewiſe invented a kind of ordnance of their own, unknown to all the world beſides. For we found, to our no ſmall amazement, that the rocks were not only cut into fortifications, but likewiſe into artillery, to defend theſe fortifications being hollowed out, in many places, into the form of immenſe mortars. The charge is ſaid to be about a barrel of gunpowder, over which they place a large piece of wood made exactly to fit the mouth of the chamber. On this they heap a great quantity of cannon-balls, ſhells, or other deadly materials; and when an enemy's ſhip approaches the harbour, they fire the whole into the air: and they pretend it produces a very great effect; making a ſhower for 200 or 300 yards round, that would ſink any veſſel.

" Notwithſtanding the ſuppoſed bigottry of the Malteſe, the ſpirit of toleration is ſo ſtrong, that a moſque has been lately built for their ſworn enemies the Turks. Here the poor ſlaves are allowed to enjoy their religion in peace. It happened lately that ſome idle boys diſturbed them during their ſervice; they were immediately ſent to priſon, and ſeverely puniſhed. The police indeed is much better regulated than in the neighbouring countries, and aſſaſſinations and robberies are very uncommon; the laſt of which crimes the grand-maſter puniſhes with the utmoſt ſeverity. He is ſaid to be much more relaxed with regard to the firſt.

" Perhaps Malta is the only country in the world where duelling is permitted by law. As their whole eſtabliſhment is originally founded on the wild and romantic principles of chivalry, they have ever found it too inconſiſtent with thoſe principles to aboliſh duelling; but they have laid it under ſuch reſtrictions as greatly to leſſen its danger. Theſe are curious enough. The duelliſts are obliged to decide their quarrel in one particular ſtreet of the city; and if they preſume to fight any where elſe, they are liable to the rigour of the law. But, what is not leſs ſingular, but much more in their favour, they are obliged, under the moſt ſevere penalties, to put up their ſwords when ordered to do ſo by a *woman,* a *prieſt,* or a *knight.* Under theſe limitations, in the midſt of a great city, one would imagine it almoſt impoſſible that a duel could ever end in blood; however, this is not the caſe: a croſs is always painted oppoſite to the ſpot where a knight has been killed, in commemoration of his fall. We counted about 20 of theſe croſſes.

" About three months ago (Mr Brydone's letter is dated June 7. 1770), two knights had a diſpute at a billiard-table. One of them, after giving a great deal of abuſive language, added a blow; but, to the aſtoniſhment of all Malta (in whoſe annals there is not a ſimilar inſtance), after ſo great a provocation, he abſolutely refuſed to fight his antagoniſt. The challenge was repeated, and he had time to reflect on the conſequences; but ſtill he refuſed to enter the liſts. He was condemned to make the *amende honorable* in the great church of St John for 45 days ſucceſſively; then to be confined in a dungeon, without light, for five years; after which, he is to remain a priſoner in the caſtle for life.

life. The unfortunate young man who received this blow is likewiſe in diſgrace, as he has not had an opportunity of wiping it out in the blood of his adverſary.

“ The horſe-races of Malta are of a very uncommon kind. They are performed without either ſaddle, briddle, whip, or ſpur ; and yet the horſes are ſaid to run full ſpeed, and to afford a great deal of diverſion. They are accuſtomed to the ground for ſome weeks before ; and although it is entirely over rock and pavement, there are very ſeldom any accidents. They have races of aſſes and mules performed in the ſame manner four times every year. The rider is only furniſhed with a machine like a ſhoemaker's awl, to prick on his courſer if he is lazy.

“ As Malta is an epitome of all Europe, and an aſſemblage of the younger brothers, who are commonly the beſt, of its firſt families, it is probably one of the beſt academies for politeneſs in this part of the globe ; beſides, where every one is intitled by law as well as cuſtom to demand ſatisfaction for the leaſt breach of it, people are under a neceſſity of being very exact and circumſpect, both with regard to their words and actions.”

Knights of MALTA, otherwiſe called *Hoſpitalers of St John of Jeruſalem*, a religious military order, whoſe reſidence is in the iſland of Malta, ſituated in the Mediterranean ſea, upon the coaſt of Africa. The Knights of Malta, ſo famous for defending Chriſtendom, had their riſe as follows :

Some time before the journey of Godfrey of Bouillon into the Holy Land, ſome Neapolitan merchants, who traded in the Levant, obtained leave of the caliph of Egypt to build an houſe for thoſe of their nation who came thither on pilgrimage, upon paying an annual tribute. Afterwards they built two churches, and received the pilgrims with great zeal and charity. This example being followed by others, they founded a church in honour of St John, and an hoſpital for the ſick ; whence they took the name of *Hoſpitalers*. A little after Godfrey of Bouillon had taken Jeruſalem, in 1099, they began to be diſtinguiſhed by black habits and a croſs with eight points ; and, beſides the ordinary, vows, they made another, which was to defend the pilgrims againſt the inſults of the infidels. This foundation was completed in 1104, in the reign of Baldwin ; and ſo their order became military, into which many perſons of quality entered, and changed the name of *hoſpitalers* into that of *knights*.

When Jeruſalem was taken, and the Chriſtians loſt their power in the Eaſt, the knights retired to Acre or Ptolemais, which they defended valiantly in 1290. Then they followed the king of Cyprus, who gave them Limiſſon in his dominions, where they ſtaid till 1310. That ſame year they took Rhodes, under the grand-maſter Foulques de Villaret, a Frenchman ; and next year defended it againſt an army of Saracens : ſince which the grand-maſters have uſed theſe four letters, F. E. R. T. i. e. *Fortitudo ejus Rhodum tenuit ;* and the order was from thence called *knights of Rhodes*.

In 1522, Soliman having taken Rhodes, the knights retired into Candia, and thence into Sicily. In 1530, Charles V. gave them the iſland of Malta, to cover his kingdom of Sicily from the Turks. In 1566, Soliman beſieged Malta ; but it was gallantly defended by the grand-maſter John de Valette Pariſot, and the Turks obliged to quit the iſland with great loſs.

The knights conſiſted of eight different languages or nations, of which the Engliſh were formerly the ſixth ; but at preſent they are but ſeven, the Engliſh having withdrawn themſelves. The firſt is that of Provence, whoſe chief is grand commendator of religion : the ſecond, of Auvergene ; whoſe chief is mareſcal of the order: the third, of France, whoſe chief is grand-hoſpitaler : the fourth, of Italy , and their chief, admiral: fifth of Arragon ; and their chief, grand-conſervator : the ſixth, of Germany ; and their chief, grand-bailiff of the order : the ſeventh, of Caſtile ; and their chief, grand-chancellor. The chief of the Engliſh was grand-commander of the cavalry.

None are admitted into this order but ſuch as are of noble birth both by father and mother's ſide for four generations, excepting the natural ſons of kings and princes. The knights are of two ſorts ; thoſe who have a right to be candidates for the dignity of grand-maſter, called *grand-croſſes ;* and thoſe who are only *knights-aſſiſtants*, who are taken from good families. They never marry ; yet have continued from 1091 to the preſent time.

The order conſiſts of three eſtates ; the knights, chaplains, and ſervants at arms. There are alſo prieſts who officiate in the churches ; friar-ſervants, who aſſiſt at the offices ; and *donnes*, or *demi-croſſes* ; but theſe are not reckoned as conſtituent parts of the body. This diviſion was made in 1130, by the grand-maſter Raimond du Puy.

The government of the order is mixed, being partly monarchical, and partly ariſtocratical. The grand-maſter is ſovereign, coins money, pardons criminals, and gives the places of grand-priors, bailiffs, knights, &c. The ordinary council is compoſed of the grand-maſter and the grand-croſſes. Every language has ſeveral grand priories, and every priory a certain number of commanderies.

The knights are received into this order, either by undergoing the trials preſcribed by the ſtatutes, or by diſpenſation. The diſpenſations are obtained either by the pope's brief, or by a general chapter of the order, and are granted in caſe of ſome defect as to the nobility of their pedigree, eſpecially on the mother's ſide. The knights are received, either as of age, under minority, or pages to the grand-maſter. They muſt be 16 years old complete before they are received : they enter into the noviciate at 17, and are profeſſed at 18. They ſometimes admit infants of one year old ; but the expence is about 4000 livres. The grand-maſter has 16 pages who ſerve him, from 12 to 16 years of age. The knights wear on the left-ſide of their cloak or waiſtcoat a croſs of white waxed cloth, with eight points, which is their true badge ; that of gold being only for ornament. When they go to war againſt the Turks, they wear a red caſſock, with a great white croſs before and behind, without points, which are the arms of the religion. The ordinary habit of the grand-maſter is a ſort of a caſſock of tabby-cloth, tied about with a girdle, at which hangs a great purſe, to denote the charitable inſtitution of the order. Over this he wears a velvet gown ; and on the left ſide a white croſs with eight points. His yearly revenue is 10,000 ducats. He acknowledges the kings of Spain, and both the Sicilies, as his protectors; and is obliged, by his agreement with the emperor Charles V. to ſuppreſs pirates.

MALTON, a town of the north-riding of Yorkſhire in England, ſeated on the river Derwent, over which there is a good ſtone-bridge. It is compoſed of two towns, the New and the Old; and is well inhabited, accommodated with good inns, and ſends two members to parliament. W. Long. 0. 30. N. Lat. 54. 8.

MALVA, the MALLOW: A genus of the polyandria order belonging to the monadelphia claſs of plants; and in the natural method ranking under the 37th order, *Columniferæ*. The calyx is double; the exterior one triphyllous; the arilli numerous and monoſpermous. There are 24 ſpecies; conſiſting of herbaceous perennials, biennials, and annuals, for medical, economical, and ornamental uſes; riſing with erect ſtalks from about half a yard to 10 or 12 feet high, garniſhed with large, roundiſh, lobated leaves, and quinquepetalous flowers. They are all eaſily and plentifully raiſed from ſeed.

The leaves of the common mallow are reckoned the firſt of the four emollient herbs: they were formerly in ſome eſteem as food for looſening the belly; at preſent, decoctions of them are ſometimes employed in dyſenteries, heat, and ſharpneſs of urine; and in general, for obtunding acrimonious humours; their principal uſe is in emollient glyſters, cataplaſms and fomentations. The leaves enter the officinal decoction for glyſters, and a conſerve is prepared from the flowers.

Several ſpecies of malva, macerated like hemp, afford a thread ſuperior to hemp for ſpinning, and which is ſaid to make more beautiful cloths and ſtuffs than even flax. Theſe ſpecies are the criſpa, Peruviana, and Mauriſinia. From the former, which affords ſtronger and much longer fibres, cords and twine have alſo been made. From the malvæ, likewiſe, a new ſort of paper has been fabricated by M. de l'Iſle. On this invention, Meſſ. Lavoiſier, Sage, and Bertholler, in name of the *Academie de Sciences*, obſerve, That "it is not probable the paper made by M. de l'Iſle will be ſubſtituted for that made from rags, either for the purpoſe of printing or writing. Yet paper from the mallows may be uſed for theſe purpoſes, if we can judge from a volume printed on it preſented to the academy. The great utility of M. de l'Iſle's invention is for furniture, which conſumes a great quantity of rags; and his papers have a natural hue, much more ſolid than can be given by colouring matter, and this hue may ſerve as a ground for other drawings. M. de l'Iſle ſhould, we think, be encouraged to purſue his experiments, which we have reaſon to expect, may be in the end very uſeful: by his zeal, activity, and knowledge, he will probably contribute to render the art of making paper more perfect; in this art he is much engaged; and his attempts, which he has ſhown to the academy, merit its praiſes."

MALVERN, GREAT and LITTLE, (with the *Chace* and the *Hills*); two towns of Worceſterſhire, England, in which were formerly two abbeys, about three miles aſunder. Since the diſſolution nothing remains of the abbey of *Great Malvern* but the gateway of the abbey and church, now parochial. Part of it was a religious cell for hermits before the Conqueſt; and the greateſt part, with the tower, built in the reign of William the Conqueror. Its outward appearance is very ſtriking. It is 171 feet in length, 63 in breadth, and 63 in height. In it are ten ſtalls; and it is ſuppoſed to have been rebuilt in the year 1171. The nave only remains in part, the ſide aiſles being in ruins. The windows have been beautifully enriched with painted glaſs, and in it are remains of ſome very ancient monuments. *Little Malvern* ſtands in a cavity of the hills, which are great lofty mountains, riſing like ſtairs, one higher than another, for about ſeven miles, and divide this country from Herefordſhire. There is a ditch here very much admired. On the hills are two medicinal ſprings, called *Holy wells* one good for the eyes, and the other for cancers. Henry VII. his queen, and his two ſons prince Arthur and prince Henry, were ſo delighted with this place, that they beautified the church and windows, part of which remain, though mutilated. In the lofty ſouth windows of the church are the hiſtorical paſſages of the Old Teſtament; and in the north windows the picture of the holy family, the nativity and circumciſion of our Saviour, the adoration of the ſhepherds and the kings, his preſentation in the temple, his baptiſm, faſting and temptation, his miracles, his laſt ſupper with his diſciples, his prayer in the garden his paſſion, death, and burial, his deſcent into hell, his reſurrection and aſcenſion, and the coming of the Holy Ghoſt. The hiſtory of our Saviours paſſion is painted differently in the eaſt window of the choir, at the expence of Henry VII. whoſe figure is therefore often repreſented, as is that of his queen. In the weſt window is a noble piece of the day of judgment, not inferior to the paintings of Michæl Angelo, *Malvern Chace* contains 7115 acres in Worceſterſhire (beſides 241 acres called the Prior's Land). 619 in Herefordſhire, and 103 in Glouceſterſhire. *Malvern Hills* run from north to ſouth, the higheſt point 1313 feet above the ſurface of the Severn at Hanley, and appear to be of lime-ſtone and quartz. On the ſummit of theſe hills is a camp with a treble ditch, imagined to be Roman, and is ſituated on the Herefordſhire ſide of the hills.

MALLEZZI (Virgilia marquis de); an Italian gentleman, born at Bologna, acquired great reputation by his learning and writings. He was well verſed in polite literature, muſic, law, phyſic, and the mathematics. He ſerved alſo in a diſtinguiſhed poſt in the army of Philip IV. king of Spain, and was employed by him in ſome important negociations. He died at Bologna in the year 1654, leaving ſeveral works in Spaniſh and Italian. Among the latter are his Diſcourſes on the Firſt Book of Tacitus; this work has been tranſlated into Engliſh.

MALUS, in botany. See PYRUS.

MAMALUKES, the name of a dynaſty that reigned in EGYPT. See that article, n° 98.

MAMBRUN (Peter), an ingenious and learned French Jeſuit, born in the dioceſe of Clermont, in the year 1581. He was one of the moſt perfect imitators of Virgil in Latin poetry, and his poems are of the ſame ſpecies: Thus he wrote *Elcogues; Georgics*, or four books on the culture of the ſoul and the underſtanding; together with a heroic poem intitled *Conſtantine or Idolatry overthrown*. He ſhowed alſo great critical abilities in a Latin *Peripatetical diſſertation on epic poetry*. He died in 1661.

MAMERTINI, a mercenary band of ſoldiers which paſſed from Campania into Sicily at the requeſt of Agathocles. When they were in the ſervice of Agathocles, they claimed the privilege of voting at the election of magiſtrates at Syracuſe, and had recourſe to arms to ſupport their unlawful demands. The ſedition was appeaſed by the authority of ſome leading men, and the Campanians were ordered to leave Sicily. In their way to the coaſt they were received with great kindneſs by the people of Meſſana, and ſoon returned perfidy for hoſpitality. They conſpired againſt the inhabitants, murdered all the males in the city, married their wives and daughters, and rendered themſelves maſters of the place. After this violence they aſſumed the name of Mamertini, and called their city Mamertum, or Mamertium, from a provincial word which in their language ſignified *martial* or *warlike*. The Mamertines were afterwards defeated by Hiero, and totally diſabled to repair their ruined affairs.

MAMMÆ, in anatomy. See there n° 112.

MAMMALIA, in natural hiſtory, the firſt claſs of animals in the Linnæan ſyſtem, divided into ſeven orders. See ZOOLOGY.

MAMMEA, *Mammee-Tree*: A genus of the monogynia order, belonging to the polyandria claſs of plants; and in the natural method ranking with thoſe of which the order is doubtful. The corolla is tetrapetalous; the calyx diphyllous; the berry very large and tetraſpermous. There are two ſpecies; both of them large evergreen trees of the hot parts of America and Aſia, and retained in hot houſes for variety; both of them adorned with large, oval, oblong, ſtiff leaves, and large quadripetalous flowers, ſucceeded by large round eatable fruit of a moſt exquiſitely rich flavour. They are propagated by ſeed, which is to be ſowed in ſmall pots of light earth, and plunged in the bark-bed, where they will ſoon come up; give gentle waterings, and about Auguſt tranſplant them into ſeparate pots a ſize larger, plunging them into the bark bed, and giving ſhade and water till freſh-rooted. In Britain they muſt never be taken out of the ſtove.

MAMMON, the god of riches, according to ſome authors; though others deny that the word ſtands for ſuch a deity, and underſtand by it only *riches* themſelves. Our Saviour ſays, We *cannot ſerve God and mammon*; that is, be religious and worldly-minded at the ſame time. Our poet Milton, by poetic licence, makes Mammon to be one of the fallen angels, and gives us his character in the following lines:

> Mammon, the leaſt erected ſpirit that fell
> From heav'n: for ev'n in heav'n his looks and thoughts
> Were always downward bent; admiring more
> The riches of heav'n's pavement, trodden gold,
> Than ought divine or holy elſe enjoy'd
> In beatic viſion: by him firſt
> Man alſo, and by his ſuggeſtion taught,
> Ranſack'd the centre, and with impious hands
> Rifled the bowels of their mother earth
> For treaſures better hid. Soon had his crew
> Open'd into the hill a ſpacious wound,
> And digg'd out ribs of gold. Let none admire
> That riches grow in hell; that ſoil may beſt
> Deſerve the precious bane.

MAMMOTH, or MAMMUTH, the name of a huge animal now unknown, to which are ſaid to have belonged thoſe tuſks, bones, and ſkeletons of vaſt magnitude, which have been frequently found in different parts of Siberia, as well in the mountains as the valleys; likewiſe in Ruſſia, Germany, and North America. Many ſpecimens of them may be ſeen in the Imperial cabinet at Peterſburgh; in the Britiſh, Dr Hunter's, and the late Sir Aſhton Lever's muſeums, and in that of the Royal Society in Britain. A deſcription of the mammoth is given by Muller in the *Recueil des Voyages au Nord*. "This animal, he ſays, is four or five yards high, and about 20 feet long. His colour is greyiſh. His head is very long, and his front very broad. On each ſide, preciſely under the eyes, there are two horns which he can move and croſs at pleaſure. In walking he has the power of extending and contracting his body to a great degree." Iſbrandes Ides gives a ſimilar account; but he is candid enough to acknowledge, that he never knew any perſon who had ſeen the mammoth alive. Mr Pennant, however, thinks it "more than probable, that it ſtill exiſts in ſome of thoſe remote parts of the vaſt new continent, impenetrated yet by Europeans. Providence (he adds) maintains and continues every created ſpecies; and we have as much aſſurance, that no race of animals will any more ceaſe while the earth remaineth, than *ſeed-time and harveſt, cold and heat, ſummer and winter, day and night*." The Ohio Indians have a tradition handed down from their fathers reſpecting theſe animals, "That in ancient times a herd of them came to the Big-bone Licks, and began an univerſal deſtruction of the bears, deer, elks, buffaloes, and other animals which had been created for the uſe of the Indians: that the Great Man above, looking down and ſeeing this, was ſo enraged that he ſeized his lightning, deſcended to the earth, ſeated himſelf upon a neighbouring mountain on a rock, on which his ſeat and the print of his feet are to ſtill be ſeen, and hurled his bolts among them till the whole were ſlaughtered, except the big bull, who preſenting his forehead to the ſhafts, ſhook them off as they fell; but at length miſſing one, it wounded him in the ſide; whereon, ſpringing round, he bounded over the Ohio, the Wabaſh, the Illinois, and finally over the great lakes, where he is living at this day.

Several eminent naturaliſts, as Sir Hans Sloane, Gmelin, Daubenton, and Buffon, are of opinion that theſe prodigious bones and tuſks are really the bones and tuſks of elephants, and many modern philoſophers have held the mammoth to be as fabulous as the centaur. The great difference in ſize they endeavour to account for as riſing from difference in age, ſex, and climate; and the cauſe of their being found in thoſe northern parts of the world where elephants are no longer natives, nor can even long exiſt, they preſume to have ariſen from hence; that, in the great revolutions which have happened in the earth, the elephants, to avoid deſtruction, have left their native country, and diſperſed themſelves wherever they could find ſafety. Their lot has been different. Some in a longer and others in a ſhorter time after their death, have been tranſported to great diſtances by ſome vaſt inundations. Thoſe, on the contrary, which ſurvived, and wandered far to the north, muſt neceſſarily have fallen victims to the vigour of the climate. Others, without reaching to ſo great a diſtance, might be drowned, or periſh with fatigue. In the year 1767, Dr Hunter, with the aſſiſtance of his brother Mr J. Hunter, had an opportunity of inveſtigating more particularly this part of natural hiſtory, and has evidently proved, that theſe foſſil bones and tuſks are not only larger than the generality of elephants, but that the tuſks are more twiſted, or have more of the ſpiral curve, than elephants teeth; and that the thigh and jaw bones differ in ſeveral reſpects from thoſe of the elephant; but what put the matter beyond all diſpute was the ſhape of the grinders, which clearly appeared to belong to a carnivorous animal, or at leaſt to an animal of the mixed kind; and to be totally different from thoſe of the elephant, which is well known not to be of the carnivorous, but graminivorous kind, both by the form of its grinders and by its never taſting animal food.—Some have ſuppoſed theſe foſſil bones to belong to the hipopotamus or river-horſe; but there are many reaſons againſt this ſuppoſition, as the hipopotamus is even much ſmaller than the elephant, and has ſuch remarkably ſhort legs, that his belly reaches within three or four inches of the ground.

North America ſeems to be the quarter where the remains in queſtion moſt abound. On the Ohio; and in many parts farther north, tuſks, grinders, and ſkeletons of unparalleled magnitude, which can admit of no compariſon with any animal at preſent known, are found in vaſt numbers, ſome lying on the ſurface of the earth, and ſome a little below it. A Mr Stanley, taken priſoner by the Indians near the mouth of the Teniſſee, relates, as Mr Jefferſon † informs us, that after being transferred through ſeveral tribes, from one to another, he was at length carried over the mountains weſt of the Miſſouri to a river which runs weſtwardly; that theſe bones abounded there; and that the natives deſcribed to him the animal to which they belonged as ſtill exiſting in the northern parts of their country; from which deſcription he judged it to be an elephant. Bones of the ſame kind have been lately found ſome feet below the ſurface of the earth, in ſalines opened on the North Holſton, a branch of the Teniſſee about the latitude of 36½° N. Inſtances are mentioned of like animal remains found in the more ſouthern climates of both hemiſpheres: but Mr Jefferſon obſerves "they are either ſo looſely mentioned, as to leave a doubt of the fact; ſo inaccurately deſcribed, as not to authoriſe the claſſing them with the great northern bones; or ſo rare, as to found a ſuſpicion that they have been carried thither as curioſities from more northern reigons. So that, on the whole, there ſeem to be no certain veſtiges of the exiſtence of this animal farther ſouth than the ſalines laſt mentioned. It is remarkable (continues he) that the tuſks and ſkeletons have been aſcribed by the naturaliſts of Europe to the elephant, while the grinders have been given to the hipopotamus or river-horſe. Yet it is acknowledged, that the tuſks and ſkeletons are much larger than thoſe of the elephant, and the grinders many times greater than thoſe of the hippopotamus, and eſſentially different in form. Wherever theſe grinders are found, there alſo we find the tuſks and ſkeleton; but no ſkeleton of the hippopotamus nor grinders of the elephant. It will not be ſaid that the hippopotamus and elephant came always to the ſame ſpot, the former to depoſit his grinders, and the latter his tuſks and ſkeleton. For what became of the parts not depoſited there? We muſt agree, then, that theſe remains belong to each other: that they are of one and the ſame animal; that this was not a hippopotamus, becauſe the hippopotamus had no tuſks nor ſuch a frame, and becauſe the grinders differ in their ſize as well as in the number and form of their points. That it was not an elephant, I think aſcertained by proofs equally deciſive. I will not avail myſelf of the authority of the celebrated anatomiſt *, who from an examination of the form and ſtructure of the tuſks has declared they were eſſentially different from thoſe of the elephant; becauſe another anatomiſt †, equally celebrated, has declared on a like examination, that they are preciſely the ſame. Between two ſuch authorities I will ſuppoſe this circumſtance equivocal. But, 1. The ſkeleton of the mammoth (for ſo the incognitum has been called) beſpeaks an animal of five or ſix times the cubic volume of the elephant, as M. de Buffon has admitted. 2. The grinders are five times as large, are ſquare, and the grinding ſurface ſtudded with four or five rows of blunt points; whereas thoſe of the elephant are broad and thin, and their grinding ſurface flat. 3. I have never heard an inſtance, and ſuppoſe there has been none, of the grinder of an elephant being found in America. 4. From the known temperature and conſtitution of the elephant, he could never have exiſted in thoſe reigons where the remains of the mammoth have been found. The elephant is a native only of the torrid zone and its vicinities; if, with the aſſiſtance of warm apartments and warm clothing, he has been preſerved in life in the temperate climates of Europe, it has only been for a ſmall portion of what would have been his natural period, and no inſtance of his multiplication in them has ever been known. But no bones of the mammoth, as I have before obſerved, have been ever found farther ſouth than the ſalines of the Holſton, and they have been found as far north as the Arctic circle. Thoſe, therefore, who are of opinion that the elephant and mammoth are the ſame, muſt believe, 1. That the elephant known to us can exiſt and multiply in the frozen zone; or, 2. That an internal fire may once have warmed thoſe regions, and ſince abandoned them, of which, however, the globe exhibits no unequivocal indications; or, 3. That the obliquity of the ecliptic, when theſe elephants lived, was ſo great as to include within the tropics all thoſe regions in which the bones are found; the tropics being, as is before obſerved, the natural limits of habitation for the elephant. But if it be admitted that this obliquity has really decreaſed, and we adopt the higheſt rate of decreaſe yet pretended, that is, of one minute in a century, to transfer the northern tropic to the Arctic circle, would, carry the exiſtence of theſe ſuppoſed elephants 250,000 years back; a period far beyond our conception of the duration of animal bones left expoſed to the open air, as theſe are in many inſtances. Beſides, though theſe regions would then be ſuppoſed within the tropics, yet their winters would have been too ſevere for the ſenſibility of the elephant. They would have had, too, but one day and one night

† *Notes on the State of Virginia*, p. 65.

* Hunter.

† D'Aubenton.

in the year; a circumſtance to which we have no reaſon to ſuppoſe the nature of the elephant fitted. However, it has been demonſtrated, that if a variation of obliquity in the ecliptic takes place at all, it is vibratory, and never exceeds the limits of nine degrees, which is not ſufficient to bring theſe bones within the tropics. One of theſe hypotheſes, or ſome other equally arbitrary and inadmiſſible to cautious philoſophy, muſt be adopted to ſupport the opinion that theſe are the bones of the elephant. For my own part, I find it eaſier to believe that an animal may have exiſted, reſembling the elephant in his tuſks and general anatomy, while his nature was in other reſpects extremely different. From the 30th degree of ſouth latitude to the 30th of north, are nearly the limits which nature has fixed for the exiſtence and multiplication of the elephant known to us. Proceeding thence northwardly to 36½ degrees, we enter thoſe aſſigned to the mammoth. The further we advance north the more their veſtiges multiply as far as the earth has been explored in that direction; and it is as probable as otherwiſe, that this progreſſion continues to the pole itſelf, if land extends ſo far. The centre of the frozen zone then may be the acmé of their vigour, as that of the torrid is of the elephant. Thus nature ſeems to have drawn a belt of ſeparation between theſe two tremendous animals whoſe breadth indeed is not preciſely known, though at preſent we may ſuppoſe it about 6½ degrees of latitude; have aſſigned to the elephant the regions ſouth of theſe confines and thoſe north to the mammoth, founding the conſtitution of the one in her extreme of heat, and that of the other in the extreme of cold. When the Creator has therefore ſeparated their nature as far as the extent of the ſcale of animal life allowed to this planet would permit, its ſeems perverſe to declare it the ſame, from a partial reſemblance of their tuſks and bones. But to whatever animal we aſcribe theſe remains it is certain ſuch a one has exiſted in America, and that it was the largeſt of all terreſtrial beings of which any traces have ever appeared."

MAMRE, an Amorite, brother of Aner and Eſchol, and friend of Abraham (Gen. xiv. 13.). It was with theſe three perſons, together with his own and their domeſtics, that Abraham purſued and overcame the kings after their conqueſt of ſodom and Gomorrah. This Mamre, who dwelt near Hebron, communicated his name to great part of the country round about. Hence we read (ch. xiii. 18. xxiii. 17, &c.), that Abraham dwelt in Mamre and in the plain of Mamre. But it is obſerved, that what we tranſlate the *plain* ſhould be rendered the *oak*, of Mamre, becauſe the word *elon* ſignifies an *oak* or *tree of a long duration*. Sozomen tells us, that this tree was ſtill extant, and famous for pilgrimages and annual feaſts, even in Conſtantine's time; that it was about ſix miles diſtant from Hebron; that ſome of the cottages which Abraham built were ſtill ſtanding near it: and that there was a well likewiſe of his digging, whereunto both Jews, Chriſtans, and Heathens, did at certain ſeaſons reſort, either out of devotion or for trade, becauſe there was held a great mart. To theſe ſuperſtitions Conſtantine the Great put a ſtop.

1
General definition and character of man.

MAN, the head of the animal creation, is a being who feels, reflects, thinks, contrives, and acts; who has the power of changing his place upon the earth at pleaſure; who poſſeſſes the faculty of communicating his thoughts by means of ſpeech; and who has dominion over all other creatures on the face of the globe. Animated and enlighened by a ray from the Divinity, he ſurpaſſes in dignity every material being. He ſpends leſs of his time in ſolitude than in ſociety, and in obedience to thoſe laws which he himſelf has framed.

In the *Syſtema Naturæ*, MAN (*Homo*) is ranked as a diſtinct genus of the order *Primates* or "Chiefs," belonging to the *Mammalia* claſs of animals, or thoſe which nouriſh their young by means of lactiferous teats or paps. Of this genus he is the only ſpecies (A); and denominated *Sapiens*, as being endowed with wiſdom far ſuperior to, or rather in excluſion of, all other animals.—He *varies*, from climate, education and habits: and the following varieties, excluſive of *wild men* (B), are enumerated by Linnæus.

2
Varieties of man, according to Linnæus, (*Syſt. Nat.* edit. 13. Gmelin. p. 22.)

α *Americans*. "Of copper-coloured complexion, choleric conſtitution, and remarkably erect."—Ther hair is black, lank, and coarſe; their noſtrils are wide; their features harſh, and the chin is ſcantily ſupplied with beard. Are obſtinate in their tempers, free and ſatisfied with their condition; and are regulated in all their proceedings by traditional cuſtoms.—Paint their ſkin with red ſtreaks.

β *Europeans*. "Of fair complexion, ſanguine temperament, and brawny form."—The hair is flowing, and of various ſhades of brown; the eyes are moſtly blue.—They are of gentle manners, acute in judgment, of quick invention, and governed by fixed laws.—Dreſs in cloſe veſtments.

γ *Aſiatics*. "Of ſooty complexion, melancholic temperament, and rigid fibre."—The hair is ſtrong, black, and lank; the eyes are dark brown.—They are of grave, haughty, and covetous manners; and are governed by opinions,—Dreſs in loſe garments.

δ, *Africans*. "Of black complexion, phlegmatic

(A) In the early editions of Linnæus, the *Troglodites* was added as another ſpecies; but is now more properly ranked under the genus *Simia*. See SIMIA.

(B) HOMINES *Ferri*; deſcribed as walking on all-fours, as being dumb, and covered with hair.—1. A youth found in Lithuania, in 1761, reſembling a bear. 2. A youth found in Heſſe, in 1544, reſembling wolf. 3. A youth in Ireland reſembling a ſheep, (*Tulp. Obſ.* iv. 9.). 4. A youth in Bamberg reſembling an ox, (*Camerarius.*) 5. A wild youth found in 1724 in Hanover. 6. Wild boys found in 1719 in the Pyrenees. 7. A wild girl found in 1717 in Overyſel. 8. A wild girl found in 1731 in Champaigne. 9. A wild lad found near Leyden, (*Boerhaave.*)—Theſe inſtances of wild men and their ſimilitudes, according to Mr Kerr†, are partly to be attributed to impoſture, and in part to exaggeration: Moſt probably (he thinks) idiots who had ſtrayed from their friends, and who reſembled the above animals only in imitating their voices.

† *Tranſlation of the Animal kingdom of Linnæus*, p. 44.

temperament, and relaxed fibre."—The hair is black and frizly; the ſkin ſoft and ſilky; the noſe flat; the lips are thick; and the female has a natural apron †, and long lax breaſts.—They are of crafty, indolent, and careleſs diſpoſitions, and governed in their actions by caprice.—Anoint the ſkin with greaſe.

ε, *Monſters*. Of theſe there are ſeverl varieties; the firſt and ſecond of which, in the following liſt, are occaſioned by the peculiarity of climate, while the reſt are produced by artificial management. 1. *Alpini;* The inhabitants of the northern mountains: they are ſmall in ſtature, active and timid in their diſpoſitions. 2. *Patagonici*: The Patagonians of South America; of vaſt ſize, and indolent in their manners. 3. *Monorchides*: The Hottentots having one teſticle extirpated. 4. *Imberbes*; moſt of the American nations who eradicate their beards and the hair from every part of the body except the ſcalp. 5. *Macrocephali*: The Chineſe who have their heads artificially forced into a conical form. 6. *Plagiocephali*: The Canadian Indians: who have the fore part of their heads flattened when young, by compreſſion.

3 Gmelin's arrangement. (*not. in loc. ubi ſupra.*)

The following arrangemement of the varieties in the human ſpecies, is offered by Dr Gmelin as more convenient than that of Linnæus.

1. White, a: (*Hom. Albus.*) Formed by the rules of ſymmetrical elegance and beauty; or at leaſt what we conſider as ſuch.—This diviſion includes almoſt all the inhabitants of Europe; thoſe of Aſia on this ſide of the Oby, the Caſpian, Mount Imaus, and the Ganges; likewiſe the natives of the north of Africa, of Greenland, and the Eſquimaux.

b, Brown: (*Hom. Badius.*) Of a yellowiſh brown colour; has ſcanty hairs, flat features, and ſmall eyes.—This variety takes in the whole inhabitants of Aſia not included in the preceding diviſion.

c. Black: (*Hom. Niger.*) Of black complexion; has frizly hair, a flat noſe, and thick lips.—The whole inhabitants of Africa, excepting thoſe of its more northern parts.

d, Copper-coloured: (*Hom. Cupreus.*) The complexion of the ſkin reſembles the colour of copper not burniſhed.—The whole inhabitants of America, except the Greenlanders and Eſquimaux.

e, Tawny: (*Hom. Fuſcus.*) Chiefly of a dark blackiſh-brown colour; having a broad noſe, and harſh coarſe ſtraight hair.—The inhabitants of the ſouthern iſlands, and moſt of the Indian iſlands.

4 Zoological deſcription of man.

The following is Linnæus's deſcription of *Man*, as tranſlated by Mr Kerr.

"The body, which ſeldom reaches ſix feet in height, is erect, and almoſt naked, having only ſome ſcattered diſtant hairs, except in ſome ſmall ſpots to be afterwards noticed, and when firſt born is entirely naked. The Head is ſhaped like an egg: the ſcalp being long, and covered with hair; the forehead broad; the top of the head flat; and the hind head protuberant. The Face is naked, having the brow or forehead flattened and quadrangular; the temples are compreſſed, with peaked angles pointing upwards and backwards towards the hairy ſcalp. The eye-brows are prominent, and covered with hairs which, ſhedding outwards, cover each other like tiles and between the inner extremities of the two eye-brows there is a ſmooth, ſhallow furrow or depreſſion, in a line with the noſe. The upper eye-lid is moveable, but the lower one hardly moves, and both are planted at their edges with a row of ſtiff recurved hairs, named *eye-laſhes*. The eye-balls are round, having no ſuſpending muſcle as in thoſe of moſt quadrupeds; the pupil, or opening of the ſight, is circular; and the eye has no *membrana nictitans*. The upper parts of the cheeks are prominent, ſoftiſh, and coloured with a red bluſh; their outer parts flattened; the lower parts are hollowed, lax, and expanſile. The noſe is prominent, and compreſſed at the ſides; its extremity or point is higher than the reſt, and blunt; the noſtrils are oval, open downwards; with thickened edges and are hairy on their inſides. The upper lip is almoſt perpendicular, and is furrowed on the middle, from the diviſion between the noſtrils to the edge of the lip; the under lip is erect, thicker and more prominent than that above; both have a ſmooth red protuberance, ſurrounding the mouth at their edges. The chin is prominent, blunt, and gibbous. In males, the face all round the mouth is covered with hair, called the *beard*, which firſt appears about puberty, in patches on the chin. The teeth in both jaws may be diſtinguiſhed into three orders; the *fore teeth* are erect, parallel, and wedge like, of the kind named *inciſors*, or *cutting teeth*; they ſtand cloſe to each other, and are more equal and rounder than in other animals; the *tuſks*, called in man *eye teeth* and *corner-teeth*, of which there is only one on each ſide of the fore-teeth in each jaw, are a little longer than the fore-teeth, but much leſs ſo than in other animals, and they are placed cloſe to the other teeth; the *grinders*, of which there are five on each ſide in both jaws, are blunt, and divided on their upper ſurface into pointed eminences; but theſe are not ſo remarkable as in other animals. The ears are placed on the ſides of the head, are of an oblong rounded figure, with a ſemilunar bend on their anterior edges; they lie flat to the head, are naked, arched at the margin on their upper and poſterior edges, and are thicker and ſoft at the under extremities.

"The Trunk of the body conſiſts of the neck, breaſt, back, and belly. The Neck is roundiſh, and ſhorter than the head; its vertebræ, or chine bones, are not, as in moſt animals connected by a ſuſpenſory ligament; the nape is hollowed; the throat, immediately below the chin, is hollowed at its upper part, and protuberant in the middle a little lower down. The Breaſt is ſomewhat flattened both before and behind: on the fore part there is a cavity or depreſſion where it joins with the neck; the arm-pits are hollow and hairy: the pit of the ſtomach is flat: On the breaſt are two diſtant, round protuberant mammæ, or dugs, each having a cylindrical obtuſe wrinkly projecting nipple, which is ſurrounded by a darker coloured circle called the *areola*. The back is flat, having protuberances on each ſide at the ſhoulder-blades, with a furrow or depreſſion between them. The abdomen or belly is large and protuberant, with a hollow at the navel; the epigaſtric region, or ſituation of the ſtomach, is flat; the hypogaſtric regions, or ſides of the belly, are protuberant; the groins flattiſh and hollowed. The pubes is hairy; the pelvis, or baſin, is wider above, and grows narrower below. The male parts are external and looſe; the penis cylindrical; the

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† A doubtful circumſtance.

ſcrotum roundiſh, lax, and wrinkled, being divided in the middle by a longitudinal ridge, or ſmooth line, which extends along the whole perinæum: The female parts are compreſſed and protuberant, having labia, nymphæ, clytoris, and hymen; and, in adults, ſecreting the catamenia. There is no external tail.

“ The Limbs conſiſt of arms and hands inſtead of fore-legs; and of thighs, legs, and feet. The Arms are placed at a diſtance from each other; they are round, and about a foot in length from the joint of the ſhoulder to the elbow; the fore-arm, or cubit, contains two bones, and is obtuſely prominent; the *ulna*, which forms the principal thickneſs of the member, is round, and ſomewhat flattened on the inſide. The Hands are broad, flat, and rounded; convex on the outſide or back of the hand, and concave on the inſide or palm. Each hand has five fingers, one of which, named the *thumb*, is ſhorter and thicker than the reſt, and is placed at ſome diſtance from them; the others are near each other, and placed parallel, the outer or *little-finger*, being the ſmalleſt; the ſecond, named *index* or *fore-finger*, and the fourth, called the *ring-finger*, are next in length and in ſize; and the third, or *middle-finger*, is the longeſt; the point of this laſt, when the arm and hand hang down, reaches to the middle of the thigh. The nails are rounded and oval, being flatly arched, or convex upwards, and each has a ſemilunar whitiſh mark at the root or lower extremity.

“ The lower limbs are placed cloſe together, having brawny muſcular haunches and ſwelling fleſhy hips; the knees are obtuſe, bend forwards, and have hollow hams behind. The Legs, which are nearly of the ſame length with the thighs, are of a muſcular make behind, where they ſwell out into what is called the *calf*; they are lean, and free of fleſh on the ſhins or fore-parts, and taper downwards to the ancle, which have hard hemiſpherical projections on each ſide, named, the *ankle-bones* or *malleolæ*. The heel is thick, prominent, and gibbous, being longer and broader than in other animals, for giving a firm ſupport to the body; it joins immediately with the ſole of the foot. The Feet are oblong, convex above, and flattened on the ſoles, which have a traverſe hollow about the middle. Each foot has five toes, ſomewhat bent downwards, and gibbous or ſwelled underneath at their extremities; they are all placed cloſe together, the inner or great-toe being thicker and ſomewhat ſhorter than the reſt; the ſecond and third are nearly of equal length; and the fourth and fifth are ſhorter than the others, the laſt mentioned or little toe being the ſhorteſt and ſmalleſt. The toe nails reſemble thoſe on the fingers, which are already deſcribed.

“ Thus man differs from the other animals in his erect poſture and naked ſkin, having a hairy ſcalp, being furniſhed with hair on the eye-brows and eye-laſhes, and having, when arrived at puberty, the pubes, breaſt, arm-pits, and the chin of the males, covered with hair. His brain is larger than that of any other animal, even the moſt enormous; he is provided with an *uvula*, and has organs of ſpeech. His face is placed in the ſame parallel line with his body; he has a projecting compreſſed noſe, and a prominent chin. His feet in walking reſt on the heel. He has no tail; and, laſtly, the ſpecies is diſtinguiſhed from other animals by ſome peculiarities of the female conſtitution, which have been already mentioned.”

Noſce Teipſum, “ Know thyſelf,” is a precept worthy of the lawgiver of Athens: it has been called the firſt ſtep to wiſdom, and was formerly written in letters of gold in the temple of Diana. In the purſuit of this important branch of knowledge, MAN may be contemplated in the ſeven following reſpects:

7
Self-knowledge, or the ſtudy of man. (*Syſt. Nat.* Kerr.)

1. PHYSIOLOGICALLY,—as a frail machine, chiefly compoſed of nerves and fibres interwoven with each other. His moſt perfect ſtate is during youth; and he is endowed with faculties more numerous, and in higher perfection, than thoſe of all other animals. “ Man, intended for exerciſing dominion over the whole animal creation, is ſent by Nature into the world naked, forlorn, and bewailing his lot; he is then unable to uſe his hands or feet, and is incapable of acquiring any kind of knowledge without inſtruction; he can neither ſpeak, nor walk, nor eat, nor perform any action whatever by natural inſtinct:” *Pliny*.— “ We may judge what kind of life is allotted to us by Nature, ſince it is ordained, as an omen, that we ſhould come weeping into the world:” *Seneca*.—“ It is humiliating to the pride of man, to conſider the pitiable origin of this moſt arrogant of all the animals:” *Pliny*.

2. DIETETICALLY.—*Cura valetudinem*. Bodily health and tranquillity of mind are more to be deſired than all the riches, pomp, or glory, of a Crœſus, a Solomon, or an Alexander. Health is to be preſerved by moderation, it is deſtroyed by abſtinence, injured by variety of delicacies, weakened by unuſual things, and ſtrengthened by the uſe of proper and accuſtomed fare. Man, learned in the pernicious art of cookery, is fond of many diſhes, rendered palatable by the injurious effects of fire, and by the baneful addition of wine. “ Hunger is ſatisfied with a ſmall quantity of food, luxury demands overabundance. Imagination requires vaſt ſupplies; while nature is contented with a moderate quantity of ordinary food, and is burthened by ſuperfluity:” *Seneca*.—According as thou liveſt, ſo ſhall thy life be enjoyed.

3. PATHOLOGICALLY.—*Memento mori!* The life of man reſembles a bubble ready to burſt; his fate is ſuſpended by a hair, and is dependent on the uncertain lapſe of time. “ The earth contains nothing more frail than man:” *Homer*.—“ Nothing is weaker than human life: To what dangers, and to how many diſeaſes, is it not expoſed? Hence the whole period of a man's life is but a ſpan: Half of it is neceſſarily ſpent in a ſtate reſembling death; without including the years of infancy, wherein there is no judgment; or the period of old age, fertile in ſufferings, during which the ſenſes are blunted, the limbs become ſtiff, and the faculties of ſight and hearing, the powers of walking, and the teeth, the inſtruments of nouriſhment, fail before the reſt of the body:” *Pliny*.—“ Thus a conſiderable part of death is ſuffered during life; and death poſſeſſes all that belonged to the times which are paſt. Finally, nature will ſpeedily recal and deſtroy all the beings which thou ſeeſt, and all that thy imagination can ſuppoſe to exiſt hereafter; for death calls equally upon all, whether they be good or whether they be evil:” *Seneca*, ii. 59.

4. NATURALLY.—*Innocui vivite, Numen adeſt!* Man, the prince of animated beings, who is a miracle of nature,

ture, and for whom all things on this earth were created, is a mimic animal, weeping, laughing, ſinging, ſpeaking; tractable, judicious, inquiſitive, and moſt wiſe; he is weak and naked, unprovided with natural weapons, expoſed to all the injuries of fortune, needful of aſſiſtance from others, of an anxious mind, ſolicitous of protection, continually complaining, changeable in temper, obſtinate in hope, and ſlow in the acquiſition of wiſdom. He diſpiſes the time which is paſt, abuſes that which is preſent, and ſets his affections on the uncertain future; thus continually neglecting winged time, which, though infinitely precious, can never be recalled; for thus the beſt and readieſt time, in every age, flies on with miſerable mortals; ſome it ſummons to attend their daily and burthenſome labours; ſome it confines to luxurious inaction, pampered even to ſuffocation with ſuperfluities; ſome it ſolicits in the ever reſtleſs paths of ambition; ſome it renders anxious for the acquiſition of wealth, and diſtreſſes by the poſſeſſion of the thing deſired; ſome it condemns to ſolitude, and others to have their doors continually crouded with viſitors; here one bewails the conduct of his children, there one grieves their loſs. Tears will ſooner fail us than their cauſes, which only oblivion can remove. “On every hand our evils overbalance our advantages; we are ſurrounded with dangers; we ruſh forwards into untried ſituations; we are enraged without having received provocation: like wild beaſts, we deſtroy thoſe we do not hate; we wiſh for favourable gales, which lead us only to deſtruction; the earth yawns wide, ready for our death:” *Seneca*.—“Other animals unite together againſt enemies of a kind different from their own, while man ſuffers moſt injuries from his own ſpecies:” *Pliny*.

5. POLITICALLY—*Eſto antiqua virtute de fide!* Man inſtead of following that which is right, is ſubjected to the guidance of manifeſt error; this envelopes all his faculties under the veil of cuſtom, as ſoon as he is born, according to its dictates, he is fed, educated, brought up, and directed, in all things; and by its arbitrary rules his honeſty, fortitude, wiſdom, morality, and religion, are judged of; thus, governed by opinion, he lives conformable to cuſtom, inſtead of being guided by reaſon. Though ſent into the world a periſhable being for all are evidently born to ſuffer, inſtead of endeavouring to ſecure thoſe things which are moſt advantageous and truly beneficial, he, infatuated by the ſmiles of fortune, anxiouſly collects her gaudy trifles for future enjoyment, and neglects her real benefits; he is driven to madneſs by envious ſnarlers; he perſecutes with hatred the truly religious for differing from himſelf in ſpeculative opinions; he excites numberleſs broils, not that he may do good, but for a purpoſe that even himſelf is ignorant of. He waſtes his precious and irrecoverable time in trifles; he thinks lightly of immortal and eternal concerns, while regulating the ſucceſſion of his poſterity; and perpetually entering on new projects, forgetful of his real condition, he builds palaces inſtead of preparing his grave; till at length, in the midſt of his ſchemes, death ſeizes him; and then, firſt opening his eyes, he perceives, O man! that all is deluſion. “Thus we live as if immortal, and firſt learn in death that we have to die;” *Seneca*.

6. MORALLY.—*Benefac et lætare!* Man is compoſed of an animated medullary ſubſtance, which prompts him to that which is right; and of a bodily frame liable to impreſſions, which inſtigates him to the enjoyment of pleaſure. In his natural ſtate he is fooliſh, wanton, an inconſiderate follower of example, ambitious, profuſe, diſſatisfied, cunning, peeviſh, invidious, malicious, and covetous; by the influence of juſt morals he is transformed to be attentive, chaſte, conſiderate, modeſt, temperate, quiet, ſincere, mild, beneficent, grateful, and contented. “Sorrow, luxury, ambition, avarice, the deſire of life, and anxiety for the future, are common to all animals:” *Pliny*.

7. THEOLOGICALLY.—*Memento Creatoris tui!* Man the ultimate purpoſe of creation, and maſterpiece of the works of Omnipotence, was placed on earth that he might contemplate its perfections; he was endowed with ſapient reaſon, and made capable of forming concluſions from the impreſſions of his ſenſes, that, from a conſideration of created objects, he might know their Creator as the Almighty, the Infinite, the Omniſcient, the Eternal God: That we may live morally under his governing care, it is requiſite that we have a thorough conviction of its exiſtence, and muſt have it ever in remembrance. Other revealed matters on this ſubject are left to be explained by the theologians.

“There are two things which lead to a knowledge of God; creation and revelation:” *Auguſtine*.—“God, therefore, may be found out by the light of nature, but is only to be known by the aſſiſtance of doctrine:” *Tertullian*.—“Man alone has the ineſtimable privilege of contemplating the perfections of God who is the author both of nature and of revelation:” *Ibid*.—“Learn that God has both ordered you to exiſt, and that you ſhould ſtudy to act that part properly which is allotted for you in life:” *Perſ.* Sat. iii. 71.

The whole of this ENCYCLOPÆDIA may in ſome reſpect be accounted an analyſis of MAN; as comprehending his knowledge of God, of himſelf, and of natural and artificial objects. In the ſequel of this article we ſhall collect into one view the moſt important particulars relating to himſelf individually, conſidered as a phyſical being, and as forming a ſubject of natural hiſtory.

6
Natural hiſtory of Man.

Anatomiſts have employed much pains in the ſtudy of the material part of man, and of that organization which determines his place in the animal creation. From tracing and combining his different external parts; from obſerving that his body is in ſome places covered with hair: that he can walk upon his hands and his feet at the ſame time, in the manner of quadrupeds; that, like certain animals which hold their food in their paws, he has two clavicles; that the female brings forth her young alive, and that her breaſts are ſupplied with milk: from theſe circumſtances we might be led to aſſign man a place in the claſs of viviparous quadrupeds. But in our opinion, ſuch an arrangement would be defective, arbitrary, and abſurd. Man is not a quadruped †: Of all the animals, he alone can ſupport himſelf, continually and without reſtraint, in an erect poſture (that is, with his head and body in a vertical line upon his legs). In this majeſtic and dignified attitude, he can change his place, ſurvey this earth which he inhabits, and turn his eyes towards the vault of heaven. By a noble and eaſy gait, he preſerves

† See *Comparative* Anatomy, Sect. i. ii.

preſerves an equilibrium in the ſeveral parts of his body, and tranſports himſelf from one place to another with different degrees of celerity (c). To man alone nature has denied a covering: but ſtill he is her maſter-piece, the laſt work which came from the hands of the Almighty Artiſt, the ſovereign and the chief of animals

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(c) M. Daubenton, after a careful examination of thoſe characters in the form of man by which he is diſtinguiſhed from other animals, has reduced them to two heads. The firſt is the ſtrength of the muſcles of the legs, by which the body is ſupported in a vertical poſition above them; the ſecond conſiſts in the articulation of the head with the neck by the middle of its baſe.

We ſtand upright, bend our body, and walk, without thinking on the power by which we are ſupported in theſe ſeveral poſitions. This power, ſays M. Daubenton, reſides chiefly in the muſcles, which conſtitute the principal part of the calf of the leg. Their exertion is felt, and their motion is viſible externally when we ſtand upright and bend our body backwards and forwards. This power is no leſs great when we walk even on an horizontal plane. In aſcending a height, the weight of the body is more ſenſibly felt than in deſcending. All theſe motions are natural to man. Other animals, on the contrary, when placed on their hind legs, are either incapable of performing them at all, or do it partially, with great difficulty, and for a very ſhort time. The *gibbon*, and the *jocko* or *ourang-outang*, are the animals moſt reſembling man in their conſtruction; they can ſtand upright with much leſs difficulty than other brutes; but the reſtraint they are under in this attitude plainly ſhows that it is not natural to them. The reaſon is, that the muſcles in the back part of the leg in the gibbon and the jocko are not, as in man, ſufficiently large to form a calf, and conſequently not ſufficiently ſtrong to ſupport the thighs and body in a vertical line, and to preſerve them in that poſture.

M. Daubenton has diſcovered, that the attitudes proper to man and to the animals are pointed out by the different manners in which the head is articulated with the neck. The two points, by which the oſſeous part of the head is connected with the firſt vertebra of the neck, and on which every movement of the head is made with the greateſt facility, are placed at the edge of the great foramen of the occipital bone, which in man is ſituated near the centre of the baſe of the cranium, affords a paſſage for the medullary ſubſtance into the vertebræ, and determines the place of the articulation of the head with the neck. The body and neck being, according to the natural attitude, in a vertical direction, the head muſt be placed in equilibrium upon the vertebræ as upon a pivot or point of ſupport. The face is on a vertical line, almoſt parallel to that of the body and neck. The jaws, which are very ſhort compared with thoſe of moſt other animals, extend very little farther forwards than the forehead.

No animal has, like man, its hind legs as long as the body, neck, and head, taken together, meaſuring from the top of the head to the os pubis.

In the frame of the human body the principal parts are nearly the ſame with thoſe of other animals; but in the connection and form of the bones, ſays M. Daubenton, there is as great a difference as in the altitudes proper to each. Were a man to aſſume the natural poſture of quadrupeds, and try to walk by the help of his hands and feet, he would find himſelf in a very unnatural ſituation; he could not move his feet and head but with the greateſt difficulty and pain; and let him make what exertions he pleaſed, he would find it impoſſible to attain a ſteady and continued pace. The principal obſtacles he would meet with would ariſe from the ſtructure of the pelvis, the hands, the feet, and the head.

The plane of the great occipital foramen, which in man is almoſt horizontal, puts the head in a kind of equilibrium upon the neck when we ſtand erect in our natural attitude; but when we are in the attitude of quadrupeds, it prevents us from raiſing our head ſo as to look forwards, becauſe the movement of the head is ſtopt by the protuberance of the occiput, which then approaches too near the vertebræ of the neck.

In moſt animals, the foramen magnum of the occipital bone is ſituated at the back part of the head; the jaws are very long; the occiput has no protuberance beyond the aperture, the plane of which is in a vertical direction, or inclined a little forwards or backwards; ſo that the head is pendant, and joined to the neck by its poſterior part. This poſition of the head enables quadrupeds, though their bodies are in a horizontal direction, to preſent their muzzle forwards, and to raiſe it ſo as to reach above them, or to touch the earth with the extremity of their jaws when they bring their neck and head down to their feet. In the attitude of quadrupeds, man could touch the earth only with the fore part or the top of the head.

To theſe differences of ſtructure, M. Daubenton adds, that when man is ſtanding, his heel reſts upon the earth as well as the other parts of his foot; when he walks it is the firſt part which touches the ground; man can ſtand on one foot: theſe are peculiarities in ſtructure and in the manner of moving which are not to be found in other animals. We may therefore conclude that a man cannot be ranked in the claſs of quadrupeds. We may add, that in man the brain is much larger, and the jaws much ſhorter, than in any other animal. The brain, by its great extent, forms the protuberance of the occipital bone, the forehead, and all that part of the head which is above the ears. In animals, the brain is ſo ſmall, that moſt of them have no occiput, or the front is either wanting or little raiſed. In animals which have large foreheads, ſuch as the horſe, the ox, the elephant, &c. they are placed as low, and even lower, than the ears. Theſe animals likewiſe want the occiput, and the top of the head is of very ſmall extent. The jaws, which form the greateſt portion of the muzzle, are large in proportion to the ſmallneſs of the brain. The length of the muzzle varies in different animals: in ſolipede animals it is very long; it is ſhort in the ourang-outang; and in man it does not exiſt at all. No beard grows on the muzzle: this part is wanting in every animal, mals, a world in miniature, the centre which connects the univerſe together. The form of his body, the organs whereof are conſtructed in ſuch a manner as to produce a much greater effect than thoſe of other animals, announces his power. Every thing demonſtrates the excellence of his nature, and the immenſe diſtance placed by the bounty of the Creator between man and beaſt. Man is a reaſonable being; brute animals are deprived of that noble faculty. The weakeſt and moſt ſtupid of the human race is able to manage the moſt ſagacious quadruped; he commands it, and makes it ſubſervient to his uſe. The operations of brutes are purely the effect of mechanical impulſe, and continue always the ſame; human works are varied without end and infinitely diverſified in the manner of execution. The ſoul of man is free, independant, and immortal. He is fitted for the ſtudy of ſcience, and the cultivation of art; he has the excluſive privilege of examining every thing which has exiſtence, and of holding communication with his fellow-creatures by language, by particular motions of the body, and by marks and characters mutually agreed upon. Hence ariſes that phyſical pre-eminence which he enjoys over all animals; and hence that power which he poſſeſſes over the elements, and (ſo to ſpeak) over nature itſelf. Man, therefore, is unequalled in his kind; but the individuals thereof differ greatly from one another in figure, ſtature, colour, manners, and diſpoſitions. The globe which man inhabits is covered with the productions of his induſtry and the works of his hands: it is his labour, in ſhort, which gives a value to the whole terreſtrial maſs.

The hiſtory of man is an object of attention highly intereſting, whether we conſider him in the different periods of his life, or take a view of the varieties of the ſpecies, or examine the wonderful organization of his frame. We ſhall, therefore, attempt to give a ſhort ſketch of him in theſe different points of view; referring occaſionally to other parts of the work for more particular details.

7 Different periods of man's life.

8 His condition at birth;

“Nothing (ſays M. Buffon) exhibits ſuch a ſtriking picture of our weakneſs, as the condition of an infant immediately after birth. Incapable of employing its organs, it needs aſſiſtance of every kind. In the firſt moments of our exiſtence, we preſent an image of pain and miſery, and are more weak and helpleſs than the young of any other animal. At birth, the infant paſſes from one element to another: When it leaves the gentle warmth of the tranquil fluid by which it was completely ſurrounded in the womb of the mother, it becomes expoſed to the impreſſions of the air, and inſtantly feels the effects of that active element. The air acting upon the olfactory nerves, and upon the organs of reſpiration, produces a ſhock ſomething like ſneezing, by which the breaſt is expanded, and the air admitted into the lungs. In the mean time, the agitation of the diaphragm preſſes upon the viſcera of the abdomen, and the excrements are thus for the firſt time diſcharged from the inteſtines, and the urine from the bladder. The air dilates the veſicles of the lungs, and after being rarefied to a certain degree, is expelled by the ſpring the dilated fibres reacting upon this rarefied fluid. The infant now reſpires; and articulates ſounds, or cries. [For the condition of the *fœtus in utero*, where it lives without reſpiration, ſee ANATOMY, nº 110; and for the nature and importance of reſpiration, ſee nº 118.]

9 and during the period of infancy.

Moſt animals are blind for ſome days after birth. Infants open their eyes to the light the moment they come into the world; but they are dull, fixed, and commonly blue. The new-born child cannot diſtinguiſh objects, becauſe he is incapable of fixing his eyes upon them. The organ of viſion is yet imperfect; the cornea is wrinkled; and perhaps the retina is too ſoft for receiving the images of external objects, and for communicating the ſenſation of diſtinct viſion. At the end of forty days, the infant begins to hear and to ſmile. About the ſame time it begins to look at bright objects, and frequently to turn its eyes towards the window, a candle, or any light. Now likewiſe it begins to weep; for its former cries and groans were not accompanied with tears. Smiles and tears are the effect of two internal ſenſations, both of which depend on the action of the mind. Thus they are peculiar to the human race, and ſerve to expreſs mental pain or pleaſure; while the cries, motions, and other marks of bodily pain and pleaſure, are common to man and moſt of the other animals. Conſidering the ſubject as metaphyſicians, we will find that pain and pleaſure are the univerſal power which ſets all our paſſions in motion.

The ſize of an infant born at the full time is commonly twenty-one inches; and that *fœtus*, which nine months before was an imperceptible bubble, now weighs ten or twelve pounds, and ſometimes more. The head is large in proportion to the body; and this diſproportion, which is ſtill greater in the firſt ſtage of the fœtus, continues during the period of infancy. The ſkin of a new-born child is of a reddiſh colour, becauſe it is ſo fine and tranſparent as to allow a ſlight tint of the colour of the blood to ſhine through. The form of the body and members is by no means perfect in a child ſoon after birth; all the parts appear to be ſwollen. At the end of three days, a kind of jaundice generally comes on, and at the ſame time milk is to be found in the breaſts of the infant, which may be ſqueezed out by the fingers. The ſwelling decreaſes as the child grows up.

The liquor contained in the amnios leaves a viſcid whitiſh matter upon the body of the child. In this country we have the precaution to waſh the new-born infant only with warm water; but it is the cuſtom with whole nations inhabiting the coldeſt climates, to plunge their infants into cold water as ſoon as they are born without their receiving the leaſt injury. It is even ſaid that the Laplanders leave their children in the ſnow till the cold has almoſt ſtopped their reſpiration, and then plunge them into a warm bath. Among theſe people, the children are alſo waſhed thrice a-day during the firſt year of their life. The inhabitants of northern countries are perſuaded that the cold bath tends to make men ſtronger and more robuſt, and on that account acuſtom their children to the uſe of it from their infancy. The truth is, that we are totally ignorant of the power of habit, or how far it can make our bodies capable of ſuffering, of acquiring, or of loſing.

The child is not allowed to ſuck as ſoon as it is born; but time is given for diſcharging the liquor and ſlime from the ſtomach, and the *meconium* or excrement, which is a black colour, from the inteſtines. As theſe ſubſtances might ſour the milk, a little diluted wine mixed with ſugar is firſt given to the infant, and the breaſt is not preſented to it before ten or twelve hours have elapſed.

The young of quadrupeds can of themſelves find the way to the teat of the mother; it is not ſo with man The mother, in order to ſuckle her child, muſt raiſe it to her breaſts: and, at this feeble period of life, the infant can expreſs its wants only by its cries.

10
Peculiar attention requiſite in rearing the young of mankind.

New-born children have need of frequent nouriſhment. During the day, the breaſt ought to be given them every two hours, and during the night as often as they awake. At firſt they ſleep almoſt continually: and they ſeem never to awake but when preſſed by hunger or pain. Sleep is uſeful and refreſhing to them; and it ſometimes becomes neceſſary to employ narcotic doſes, proportioned to the age and conſtitution of the child. for the purpoſe of procuring them repoſe. The common way of appeaſing the cries of children is by rocking them in the cradle; but this agitation muſt be very gentle, otherwiſe a great riſk is run of confuſing the infant's brain, and of producing a total derangement. It is neceſſary to their being in good health, that their ſleep be long and natural. It is poſſible, however, that they may ſleep too much, and thereby endanger their conſtitution. In that caſe, it would be proper to take them out of the cradle, and awaken them by a gentle motion, or by preſenting ſome bright object to their eyes. At this age we receive the firſt impreſſions from the ſenſes, which, without doubt, are more important during the reſt of life than is generally imagined. Great care ought to be taken to place the cradle in ſuch a manner that the child ſhall be directly oppoſite to the light; for their eyes are always directed towards that part of the room where the light is ſtrongeſt; and, if the cradle be placed ſideways, one of them, by turning towards the light, will acquire greater ſtrength than the other, and the child will ſquint. For the two firſt months, no other food ſhould be given to the child but the milk of the nurſe; and, when it is of a weak and delicate conſtitution, this nouriſhment alone ſhould be continued during the third or fourth month. A child however robuſt and healthful, may be expoſed to great danger and inconvenience, if any other aliment is adminiſtered before the end of the firſt month. In Holland. Italy, Turkey. and the whole Levant, the food of children is limited to the milk of the nurſe for a whole year. The ſavages of Canada give their children ſuck for four, five, and ſometimes even ſeven years. In this country, as nurſes generally have not a ſufficient quantity of milk to ſatisfy the appetite of their children, they commonly ſupply the want of it by panada or other light preparations.

The teeth uſually begin to appear about the age of ſeven months. The cutting of theſe, although a natural operation, does not follow the common laws of nature, which acts continually on the human body without occaſioning the ſmalleſt pain or even producing any ſenſation. Here a violent and painful effort is made, accompanied with cries and tears. Children at firſt loſe their ſprightlineſs and gaiety; they become ſad, reſtleſs, and fretful. The gums are red, and ſwelled; but they afterwards become white, when the preſſure of the teeth is ſo great as to ſtop the circulation of the blood. Children apply their fingers to their mouth, that they may remove the irritation which they feel there. Some relief is given, by putting into their hands a bit of ivory or of coral, or of ſome other hard and ſmooth body, with which they rub the gums at the affected part. This preſſure, being oppoſed to that of the teeth, calms the pain for a moment, contributes to make the membrane of the gum thinner, and facilitates its rupture. Nature here acts in oppoſition to herſelf: and an inciſion of the gum muſt ſometimes take place, to allow a paſſage to the tooth. For the period of dentition, number of teeth, &c. ſee ANATOMY, nº 17.

When children are allowed to cry too long and too often, ruptures are ſometimes occaſioned by the efforts they make. Theſe may eaſily be cured by the ſpeedy application of bandages: but if this remedy has been too long delayed, the diſeaſe may continue through life. Children are very much ſubject to worms. Some of the bad effects occaſioned by theſe animals might be prevented by giving them a little wine now and then, for fermented liquors have a tendency to prevent their generation.

Though the body is very delicate in the ſtate of infancy, it is then leſs ſenſible of cold than at any other part of life. The internal heat appears to be greater: the pulſe in children is much quicker than in adults; from which we are certainly intitled to infer that the internal heat is greater in the ſame proportion. For the ſame reaſon, it is evident that ſmall animals have more heat than large ones; for the beating of the heart and of the arteries is always quicker in proportion to the ſmallneſs of the animal. The ſtrokes of the heart in a ſparrow ſucceed one another ſo rapidly that they can ſcarcely be counted.

11
The great mortality to which children are ſubject.

Till three years of age, the life of a child is very precarious. In the two or three following years, it becomes more certain; and at ſix or ſeven years of age a child has a better chance of living than at any other period of life. From the bills of mortality publiſhed at London, it appears, that of a certain number of children born at the ſame time, one half of them die the three firſt years: according to which, one half of the human race are cut off before they are three years of age. But the mortality among children is not nearly ſo great every where as in London. *M. Dupre de Saint-Maur*, from a great number of obſervations made in France, has ſhown that half of the children born at the ſame time are not extinct till ſeven or eight years have elapſed.

Among the cauſes which have occaſioned ſo great a mortality among children, and even among adults, the ſmall pox may be ranked as the chief: But luckily the means of alleviating by inoculation the fatal effects of this terrible ſcourge are now univerſally known. See INOCULATION, and *MEDICINE-Index*.

12
Speech, when it commences.

Children begin learning to ſpeak about the age of twelve or fifteen months. In all languages, and among every people, the firſt ſyllables they utter are *ba, ba, ma, ma, pa, pa, taba, abada*: nor ought this to excite any ſurpriſe, when we conſider that theſe ſyllables are the ſounds moſt natural to man, becauſe they conſiſt of that vowel, and thoſe conſonants, the pronunciation of which require the ſmalleſt exertion in the organs of ſpeech. Some children at two years of age articulate diſtinctly, and repeat whatever is ſaid to them; but moſt children do not ſpeak till the age of two years and a half, or three years, and often later.

The life of man and of other animals is meaſured only from the moment of birth: they enjoy exiſtence, however, previous to that period, and begin to live in the ſtate of a fœtus. This ſtate is deſcribed and explained under the article ANATOMY, n° 110. The period of infancy, which extends from the moment of birth to about twelve years of age, has juſt now been conſidered.

13
Period of puberty and adoleſcence.

The period of infancy is followed by that of adoleſcence. This begins, together with puberty, at the age of twelve or fourteen, and commonly ends in girls at fifteen, and in boys at eighteen, but ſometimes not till twenty-one, twenty-three, and twenty-five years of age. According to to its etymology (being derived from the Latin word *adoleſcentia*), it is completed when the body has attained its full height. Thus, puberty accompanies adoleſcence, and precedes youth. This is the ſpring of life; this is the ſeaſon of pleaſures, of loves, and of graces: but alas! this ſmiling ſeaſon is of ſhort duration. Hitherto nature ſeems to have had nothing in view but the preſervation and increaſe of her work: ſhe has made no proviſion for the infant except what is neceſſary to its life and growth. It has lived, or rather enjoyed a kind of vegetable exiſtence, which was ſhut up within itſelf, and which it was incapable of communicating. In this firſt ſtage of life, reaſon is ſtill aſleep: but the principles of life ſoon multiply, and man has not only what is neceſſary to his own exiſtence, but what enables him to give exiſtence to others. This redundancy of life, this ſource of health and vigour, can no longer be confined, but endeavours to diffuſe and expand itſelf.

14
Symptoms of puberty.

The age of puberty is announced by ſeveral marks. The firſt ſymptom is a kind of numbneſs and ſtiffneſs in the groins, accompanied with a new and peculiar ſenſation in thoſe parts which diſtinguiſh the ſexes. There, as well as in the arm-pits, ſmall protuberances of a whitiſh colour appear, which are the germs of a new production of a kind of hair, by which theſe parts are afterwards to be veiled. The voice, for a conſiderable time, is rough and unequal: after which it becomes fuller, ſtronger, and graver, than it was before. This change may eaſily be diſtinguiſhed in boys; but leſs ſo in girls, becauſe their voices are naturally ſharper. Theſe marks of puberty are common to both ſexes: but there are marks peculiar to each, ſuch as the diſcharge of the menſes, and the growth of the breaſts, in girls; the beard, and the emiſſion of ſemen in boys; in ſhort, the feeling of venereal deſire, and the appetite which unites the ſexes. Among all races of mankind, the females arrive at puberty ſooner than the males; but the age of puberty is different in different nations, and ſeems partly to depend on the temperature of the climate and the quality of the food. In all the ſouthern countries of Europe, and in cities, the greateſt part of girls arrive at puberty about twelve, and boys about fourteen years of age. But in the northern parts, and in the country, girls ſcarcely arrive at puberty till they are fourteen or fifteen, and boys not till they are ſixteen or ſeventeen. In our climate, girls, for the greateſt part, have attained complete maturity at eighteen, and boys at twenty years of age.

At the age of adoleſcence, and of puberty, the body commonly attains its full height. About that time, young people ſhoot out ſeveral inches almoſt at once. But there is no part of the human body which increaſes more quickly and more perceptibly than the organs of generation in both ſexes. In males, this growth is nothing but an unfolding of the parts, an augmentation in ſize; but in females it often occaſions a ſhrinking and contraction, which have received different names from thoſe who have treated of the ſigns of virginity. See VIRGINITY.

15
Effects of puberty.

Marriage is a ſtate ſuitable to man, wherein he muſt make uſe of thoſe new faculties which he has acquired by puberty. At this period of life, the deſire of producing a being like himſelf is ſtrongly felt. The external form and the correſpondence of the organs of ſex, occaſion without doubt that irreſiſtible attraction which unites the ſexes and perpetuates the race. By connecting pleaſure with the propagation of the ſpecies, nature has provided moſt effectually for the continuance of her work. *Increaſe and multiply*, is the expreſs command of the Creator, and one of the natural functions of life. We may add, that at the age of puberty a thouſand impreſſions act upon the nervous ſyſtem, and reduce man to ſuch a ſituation that he feels his exiſtence only in that voluptuous ſenſe, which then appears to become the ſeat of his ſoul, which engroſſes the whole ſenſibility of which he is ſuſceptible, and which proceeds to ſuch a height, that its attacks cannot long be ſupported without a general derangement of the whole machine. The continuance of ſuch a feeling may ſometimes indeed prove fatal to thoſe who indulge in exceſſive enjoyment; but it is equally dangerous to thoſe who obſtinately perſiſt in celibacy, eſpecially when ſtrongly ſolicited by nature. The ſemen, being too long confined in the ſeminal veſſels, may, by its ſtimulant property, occaſion diſeaſes in both ſexes, and excite irritations ſo violent as to reduce man to a level with the brutes, which, when acted upon by ſuch impreſſions, are perfectly furious and ungovernable. When this irritation proceeds to extremity, it produces what is called the *furor uterinus* in women.

16
Its too frequent abuſe.

The oppoſite habit, however, is infinitely more common, eſpecially in the temperate, and above all in the frozen zones. After all, exceſs is much more to be dreaded than continency. The number of diſſolute and intemperate men afford us plenty of examples. Some have loſt their memory, ſome have been deprived of ſight, ſome have become bald, and ſome have died through mere weakneſs. In ſuch a caſe, bleeding is well known to be fatal. Young men cannot be too often warned of the irreparable injury they may do to their health; and parents, to whoſe care they are entruſted, ought to employ all the means in their power to turn them from ſuch dangerous exceſſes.

17
Great importance of this ſeaſon of life.

But at the age of puberty, young men know not of how much importance it is to prolong this ſmiling ſeaſon of their days, whereon the happineſs or miſery of their future life ſo much depends. Then they look not forward to futurity, nor reflect on what is paſt, nor enjoy preſent pleaſures with moderation. How many ceaſe to be men, or at leaſt to have the faculties of men, before the age of thirty? Nature muſt not be forced; like a true mother, her object is the ſober and diſcreet union of the ſexes. It is ſufficient to obey when ſhe commands, and to anſwer when ſhe calls. Neither muſt we forget here to mention and condemn an outrage committed againſt nature, the ſhameful practice of which endangers the loſs of health, and the total ruin of the conſtitution; we mean that ſolitary libertiniſm (*maſturbatio*), by which a man or woman, deceiving nature as it were, endeavours to procure thoſe enjoyments which religion has forbidden except when connected with the happineſs of being a parent. Such then is the phyſical order which the Author of nature, the great preſerver of the ſpecies as well as of the individual, has appointed to induce man, by the attraction of pleaſure, to propagate and continue his race.

18 Of procreation. The procreation of children is the object of marriage; but ſometimes this object fails to be accompliſhed. See IMPOTENCE and STERILITY.

According to the ordinary courſe of nature, women are not fit for conception till after the firſt appearance of the menſes. When theſe ſtop which generally happens about forty or fifty years of age, they are barren ever after. Their breaſts then ſhrink and decay, and the voice becomes feebler. Some, however, have become mothers before they have experienced any menſtrual diſcharge; and others have conceived at the age of ſixty, and ſometimes at a more advanced age. Such examples, though not unfrequent, muſt be conſidered as exceptions to the general rule; but they are ſufficient to ſhow that the menſtrual diſcharge is not eſſential to generation The age at which man acquires the faculty of procreating is not ſo diſtinctly marked. In order to the production of ſemen, the body muſt have attained a certain growth, which generally happens between twelve and eighteen years of age. At ſixty or ſeventy, when the body begins to be enervated by old age, the voice becomes weaker, the ſemen is ſecreted in ſmaller quantities, and it is often unprolific. There are inſtances, however, of old men who have procreated at the age of eighty or ninety. Boys have been found who had the faculty of generating at nine, ten, and eleven; years of age; and young girls who have become pregnant at the age of ſeven, eight, or nine. But ſuch facts, which are very rare, ought to be conſidered as extraordinary phænomena in the courſe of nature.

19 Pregnancy. Pregnancy is the time during which a woman carries in her womb the fruit of conception. It begins from the moment the prolific faculty has been reduced into act, and all the conditions requiſite in both ſexes have concurred to form the rudiments of a male or female fœtus; and it ends with delivery. As ſoon as a woman is declared pregnant, ſays the author of the eſſay *Sur la maniere de perfectioner l'eſpece humaine*, ſhe ought to direct her attention wholly to herſelf, and make the wants of her offspring the ſtandard of her actions. She is now become the depoſitary of a new creature ſimilar to herſelf, and differing only in the proportion and ſucceſſive unfolding of its parts. She muſt be highly careful not to lace herſelf tight, to avoid exceſſive ſtretchings, and in ſhort, to diſturb in no reſpect the natural ſtate of the womb. She muſt likewiſe beware of indulging certain paſſions, for we ſhall afterwards ſee what great changes are produced in the animal œconomy by ſtrong and violent paſſions.

An explanation, then, of what takes place during pregnancy, is nothing but a hiſtory of the formation of the fœtus; of its expanſion; of the extraordinary manner in which it lives, is nouriſhed and grows in its mother's womb, and of the way in which all theſe operations are performed with regard to both: for which ſee ANATOMY, no 109, 110. It has been proved by many obſervations, that the fœtus changes its poſition in the womb, according to the different attitudes of the mother. It is commonly ſituated with its feet downwards, the breech reſting upon the heels, the head bent towards the knees, the hands bent towards the mouth, the feet turned inwards; and in this poſition it ſwims like a kind of veſſel in the watery fluid contained in the membranes by which it is ſurrounded, without occaſioning any inconvenience to the mother, except what ariſes from its motions, ſometimes to the one ſide, and ſometimes to the other. At times, it even kicks with ſuch violence as to frighten the mother. But when once the head becomes ſufficiently large to deſtroy the equilibrium, it tumbles over and falls downwards; the face is turned towards the *os ſacrum*, and the crown of the head towards the orifice of the *uterus*. This happens ſix weeks or two months before delivery. When the time of delivery arrives, the fœtus, finding itſelf too much confined in the womb, makes an effort to eſcape with its head firſt. At length, at the moment of delivery, it unites its own ſtrength with that of the mother, and opens the orifice of the *uterus* wide enough to allow a paſſage for itſelf. It happens ſometimes that the fœtus eſcapes from the *uterus* without burſting its covering, as is the caſe with animals. But, in general, the human fœtus pierces the membranes by its efforts; and ſometimes a very thin part of them remains upon the head like a cap. The ancients conſidered this membranous covering as a ſign of good fortune; and the ſame idea is ſtill prevalent among the vulgar. The liquor which eſcapes during delivery is called the *waters* of the mother. Theſe waters ſerve to guard the fœtus from external injuries, by eluding the violence of the blows which the mother may receive upon the belly: and, in the ſame 20 Parturition manner, they defend the womb from the ſhocks occaſioned by the motions of the fœtus. In ſhort, by rendering the paſſage ſoft and pliable, they facilitate the eſcape of the child in the time of delivery. (See MIDWIFERY.).—In the womb, the fœtus does not reſpire, as has been already mentioned; conſequently what has been ſaid of the cries of children in the womb, muſt be conſidered as altogether fabulous.—Women have generally only one child at a birth. When they bear two, three, or more, the fœtuſes are ſeldom found under the ſame covering; and their placentæ, though adhering, are almoſt always diſtinct. Twins are not uncommon, but there are ſeldom more. It is ſuppoſed that among women with child, there is only one in 2500 who brings forth three children at a birth, one in 20,000 who brings forth four, and one in a million who brings forth five. When the number amounts, to five or even when there are but three or four, they are generally of a weakly conſtitution; moſt of them die in the womb, or ſoon after delivery. See the article PROLIFIC.

At the age of puberty or a few years after, the body attains its full ſtature. Some young men grow

21 Period of youth.

no taller after 15 or 16, and others continue to grow till the age of 20 or 23. At this period they are very ſlender; but by degrees the members ſwell and begin to aſſume their proper ſhape; and before the age of 30, the body in men has attained its greateſt perfection with regard to ſtrength, conſiſtence, and ſymmetry. Adoleſcence ends at the age of 20 or 25; and at this period youth (according to the diviſion which has been made of the years of man's life into different ages) begins. It continues till the age of 30 or 35.

22 Stature of man.

The common ſtature of men is about five feet and three, four, five, ſix, or ſeven inches; and of women about five feet and two, three, or four inches. Men below five feet are of a ſmall ſtature. The Laplanders do not exceed four feet and a half; and the natives of ſome other countries are ſtill ſmaller. Women attain their full height ſooner than men. Haller computes, that in the temperate climates of Europe, the medium ſtature of men is about five feet and five or ſix inches. It is obſerved by the ſame author, that in Switzerland the inhabitants of the plains are taller than thoſe of the mountains. It is difficult to aſcertain with preciſion the actual limits of the human ſtature. In ſurveying the inhabited earth, we find greater differences in the ſtatures of individuals than in thoſe of nations. In the ſame climate, among the ſame people, and ſometimes in the ſame family, there are men whoſe ſtature is either too tall or too diminutive. See the articles GIANT and DWARF.

23 State of manhood.

The body having acquired its full height during the period of adoleſcence, and its full dimenſions in youth, remains for ſome years in the ſame ſtate before it begins to decay. This is the period of manhood which extends from the age of 30 or 35 to that of 40 or 45 years. During this ſtage, the powers of the body continue in full vigour, and the principal change which takes place in the human figure ariſes from the formation of fat in different parts. Exceſſive fatneſs disfigures the body, and becomes a very cumberſome and inconvenient load.

24 Nobleneſs of the human form and movements.

The body of a well-ſhaped man ought to be ſquare, the muſcles ought to be ſtrongly marked, the contour of the members boldly delineated, and the features of the face well defined. In women all the parts are more rounded and ſofter, the features are more delicate, and the complexion brighter. To man belong ſtrength and majeſty; gracefulneſs and beauty are the portion of the other ſex. The ſtructure eſſential to each will be found in the deſcription of the human ſkeleton, under the article ANATOMY.

Every thing in both ſexes points them out as the ſovereigns of the earth; even the external appearance of man declares his ſuperiority to other living creatures. His body is erect; his attitude is that of command; his auguſt countenance, which is turned towards heaven, bears the impreſſions of his dignity. The image of his ſoul is painted in his face; the excellence of his nature pierces through the material organs, and gives a fire and animation to the features of his countenance. His majeſtic deportment, his firm and emboldened gait, announce the nobleneſs of his rank. He touches the earth only with his extremity; he views it only at a diſtance, and ſeems to deſpiſe it. It has been juſtly obſerved, that the countenance of man is the mirror of his mind. In the looks of no animal are the expreſſions of paſſion painted with ſuch energy and rapidity, and with ſuch gentle gradations and ſhades, as in thoſe of man. We know, that in certain emotions of the mind, the blood riſes to the face, and produces bluſhing; and that in others, the countenance turns pale. Theſe two ſymptoms, the appearance of which depends on the ſtructure and the tranſparency of the reticulum, eſpecially redneſs, conſtitute a peculiar beauty. In our climates, the natural colour of the face of a man in good health is white, with a lively red ſuffuſed upon the cheeks. Paleneſs of the countenance is always a ſuſpicious ſymptom. That colour which is ſhaded with black is a ſign of melancholy and of vitiated bile; and conſtant and univerſal redneſs, is a proof that the blood is carried with too great impetuoſity to the brain. A livid colour is a morbid and dangerous ſymptom; and that which has a tint of yellow is a ſign of jaundice or repletion of bile. The colour of the ſkin is frequently altered by want of ſleep or of nouriſhment, or by looſeneſs and diarrhœa.

25 Diverſity of the countenance.

Notwithſtanding the general ſimilitude of countenance in nations and families, there is a wonderful diverſity of features. No one, however, is at a loſs to recollect the perſon to whom he intends to ſpeak, provided he has once fully ſeen him. One man has livelineſs and gaiety painted in his countenance, and announces before-hand, by the cheerfulneſs of his appearance, the character which he is to ſupport in ſociety. The tears which bedew the cheeks of another man would excite compaſſion in the moſt unfeeling heart. Thus the face of man is the rendezvous of the ſymptoms both of his moral and phyſical affections: tranquillity, anger, threatening, joy, ſmiles, laughter, malice, love, envy, jealouſy, pride, contempt, diſdain or indignation, irony, tears, arrogance, terror, aſtoniſhment, horror, fear, ſhame or humiliation, ſorrow and affliction, compaſſion, meditation, particular convulſions, ſleep, death, &c. &c. The difference of theſe characters appears to us of ſufficient importance to form a principal article in the natural hiſtory of man.

26 Analyſis of the features.

When the mind is at eaſe, all the features of the face are in a ſtate of profound tranquillity. Their proportion, harmony, and union, point out the ſerenity of the thoughts. But when the ſoul is agitated, the human face becomes a living canvas, whereon the paſſions are repreſented with equal delicacy and energy, where every motion of the ſoul is expreſſed by ſome feature, and every action by ſome mark; the lively impreſſion of which anticipates the will, and reveals by pathetic ſigns our ſecret agitation, and thoſe intentions which we are anxious to conceal. It is particularly in the eyes that the ſoul is painted in the ſtrongeſt colours and with the moſt delicate ſhades.

The different colours of the eyes are, dark hazel, light hazel, green, blue, gray, and whitiſh-gray. The moſt common of theſe colours are hazel and blue, both of which are often found in the ſame eye. Eyes which are commonly called black, are only dark hazel; they appear black in conſequence of being contraſted with the white of the eye. Wherever there is a tint of blue, however ſlight, it becomes the prevailing colour, and outſhines the hazel, with which it is intermixed, to ſuch a degree, that the mixture cannot be perceived without a very narrow examination. The moſt beautiful eyes are thoſe which appear black or blue. In the former, there is more expreſſion and vivacity; in the latter, more ſweetneſs and perhaps delicacy.

Next to the eyes, the parts of the face by which the phyſiognomy is moſt ſtrongly marked, are the eye-brows. Being of a different nature from the other parts, their effect is increaſed by contraſt. They are like a ſhade in a picture, which gives relief to the other colours and forms.

The fore-head is one of the largeſt parts of the face and contributes moſt to its beauty. Every body knows of how great importance the hair is in the phyſiognomy; and that baldneſs is a very great defect. When old age begins to make its approaches, the hair which firſt falls off is that which covers the crown of the head and the parts above the temples. We ſeldom ſee the hair of the lower part of the temples, or of the back of the head, completely fall off. Baldneſs is peculiar to men: women do not naturally loſe their hair, tho' it becomes white as well as that of the men at the approach of old age.

The noſe is the moſt prominent feature of the face. But as it has very little motion, and that only in the moſt violent paſſions, it contributes leſs to the expreſſion than to the beauty of the countenance. The noſe is ſeldom perpendicular to the middle of the face, but for the moſt part is turned to one ſide or the other. The cauſe of this irregularity, which, according to the painters, is perfectly conſiſtent with beauty, and of which even the want would be a deformity, appears to be frequent preſſure on one ſide of the cartilage of the child's noſe againſt the breaſt of the mother when it receives ſuck. At this early period of life, the cartilages and bones have acquired very little ſolidity, and are eaſily bent, as may be obſerved in the legs and thighs of ſome individuals, who have been injured by the bandages of the ſwaddling clothes.

27 The motions produced in them by the paſſions.

Next to the eyes, the mouth and lips have the greateſt motion and expreſſion. Theſe motions are under the influence of the paſſions. The mouth, which is ſet off by the vermilion of the lips and the enamel of the teeth, marks by the various forms which it aſſumes, their different characters. The organ of the voice likewiſe gives animation to this feature, and communicates to it more life and expreſſion than is poſſeſſed by any of the reſt. The cheeks are uniform features, and have no motion or expreſſion excepting from that involuntary redneſs or paleneſs with which they are covered in different paſſions, ſuch as ſhame, anger, pride, and joy, on the one hand; and fear, terror, and ſorrow on the other.

In different paſſions, the whole head aſſumes different poſitions, and is affected with different motions. It hangs forward during ſhame, humility and ſorrow; it inclines to one ſide in languor and compaſſion; it is elevated in pride, erect and fixed in obſtinacy and ſelf-conceit: In aſtoniſhment it is thrown backwards; and it moves from ſide to ſide in contempt, ridicule, anger, and indignation.

In grief, joy, love, ſhame, and compaſſion, the eyes ſwell, and the tears flow. The effuſion of tears is always accompanied with an extenſion of the muſcles of the face, which opens the mouth.

In ſorrow, the corners of the mouth are depreſſed, the under-lip riſes, the eye-lids fall down, the pupil of the eye is raiſed and half concealed by the eye-lid. The other muſcles of the face are relaxed, ſo that the diſtance between the eyes and the mouth is greater than ordinary; and conſequently the countenance appears to be lengthened.

In fear, terror, conſternation, and horror, the fore-head is wrinkled, the eye-brows are raiſed, the eye-lids are opened as wide as poſſible, the upper lip uncovers a part of the white above the pupil, which is depreſſed and partly concealed by the under lip. At the ſame time the mouth opens wide, the lips recede from each other, and diſcover the teeth both above and below.

In contempt and deriſion, the upper lip is raiſed at one ſide and expoſes the teeth, while the other ſide of the lip moves a little and wears the appearance of a ſmile. The noſtril on the elevated ſide of the lip ſhrivels up, and the corner of the mouth falls down. The eye on the ſame ſide is almoſt ſhut, while the other is open as uſual; but the pupils of both are depreſſed, as when one looks down from a height.

In jealouſy, envy, and malice, the eye-brows fall down and are wrinkled; the eye-lids are elevated and the pupils are depreſſed. The upper lip is elevated on both ſides while the corners of the mouth are a little depreſſed, at the under lip riſes to join the middle of the upper.

In laughter, the corners of the mouth are drawn back and a little elevated; the upper parts of the cheeks riſe; the eyes are more or leſs cloſed; the upper lip riſes, and the under one falls down, the mouth opens; and in caſes of immoderate laughter, the ſkin of the noſe wrinkles. That gentler and more gracious kind of laughter which is called *ſmiling*, is ſeated wholly in the parts of the mouth. The under lip riſes; the angles of the mouth are drawn back; the cheeks are puffed up; the eye lids approach one another; and a ſmall twinkling is obſerved in the eyes. It is very extraordinary, that laughter may be excited either by a moral cauſe without the immediate action of external objects, or by a particular irritation of the nerves without any feeling of joy. Thus an involuntary laugh is excited by a ſlight tickling of the lips, of the palm of the hand, of the ſole of the foot, of the arm-pits, and, in ſhort, below the middle of the ribs. We laugh when ſome diſſimilar ideas, the union of which was unexpected, are preſented to the mind at the ſame time, and when one or both of theſe ideas, or their union, includes ſome abſurdity which excites an emotion, of diſdain mingled with joy. In general, ſtriking contraſts never fail to produce laughter.

A change is produced in the features of the countenance by weeping as well as by laughing. When we weep, the under lip is ſeparated from the teeth, the forehead is wrinkled, the eye-brows are depreſſed; the dimple, which gives a gracefulneſs to laughter, forſakes the cheek, the eyes are more compreſſed, and almoſt conſtantly bathed in tears, which in laughter flow more ſeldom and leſs copiouſly.

The arms, hands, and every part of the body; contribute to the expreſſion of the paſſions. In joy, for inſtance, all the members of the body are agitated with quick and various motions. In languor and ſorrow, the arms hang down, and the whole body remains fixed and immoveable. In admiration and ſurpriſe, this total ſupenſion of motion is likewiſe obſerved. In love, deſire and hope, the head and eyes are raiſed to heaven, and ſeem to ſolicit the wiſhed-for good; the body leans forwards as if to approach it; the arms are ſtretched out, and ſeem to ſeize before-hand the beloved object. On the contrary, in fear, hatred, and horror, the arms ſeem to puſh backward and repel the object of our averſion; we turn away our head and eyes as if to avoid the ſight of it, we recoil in order to ſhun it.

28 Vigour, &c. of the human body.

Although the human body is externally much more delicate than that of any other animal, yet it is very nervous, and perhaps ſtronger in proportion to its ſize than that of the ſtrongeſt animals. We are aſſured that the porters at Conſtantinople carry burthens of 900 pounds weight. A thouſand wonderful ſtories are related of the Hottentots and other ſavages concerning their agility in running. Civilized man knows not the full extent of his powers, nor how much he loſes by that effeminacy and inactivity by which they are weakened and deſtroyed. He is contented even to be ignorant of the ſtrength and vigour which his members are capable of acquiring by motion, and by being accuſtomed to ſevere exerciſes, as is obſerved in runners, tumblers and, rope dancers. The concluſion is therefore founded on the moſt juſt and indiſputable induction and analogy.—The attitude of walking is leſs fatiguing to man than that in which he is placed when he is ſtopped in running. Every time he ſets his foot upon the ground, he paſſes over a more conſiderable ſpace; the body leans forwards, and the arms follow the ſame direction; the reſpiration increaſes, and breathing becomes difficult. Leaping begins with great inflexions of the members; the body is then much ſhortened, but immediately ſtretches itſelf out with a great effort. The motions which accompany leaping make it very fatiguing.

29 Reſtoration of its powers by ſleep

It is obſerved by M. Daubenton (*Nouvelle Encyclopedie*), that a ceſſation from exerciſe is not alone ſufficient to reſtore the powers of the Body when they are exhauſted by fatigue. The ſprings, though not in action, are ſtill wound up while we are awake, even when every movement is ſuſpended. In ſleep nature finds that repoſe which is ſuited to her wants, and the different organs enjoy a ſalutary relaxation. This is that wonderful ſtate in which man, unconſcious of his own exiſtence, and ſunk in apparent death, repairs the loſs which his faculties has ſuſtained, and ſeems to aſſume a new exiſtence. In this ſtate of drowſineſs and repoſe, the ſenſes ceaſe to act, the functions of the ſoul are ſuſpended, and the body ſeems abandoned to itſelf. The external ſymptoms of ſleep, which alone are the object of our attention, are eaſily diſtinguiſhed. At the approach of ſleep the eyes begin to wink, the eye-lids fall down, the head nods and hangs down: its fall aſtoniſhes the ſleeper; he ſtarts up, and makes an effort to drive away ſleep, but in vain; a new inclination, ſtronger than the former, deprives him of the power of raiſing his head; his chin reſts upon his breaſt, and in this poſition he enjoys a tranquil ſleep. See the article Sleep.

30 The period of decline.

Phyſiologiſts give the name of old age to that period of life which commences immediately after the age of manhood and ends at death; and they diſtinguiſh green old age from the age of decrepitude. But in our opinion, ſuch an extenſive ſignification of the word ought not to be admitted. We are not old men at the age of forty or forty-five; and though the body then give ſigns of decay, it has not yet arrived at the period of old age. M. Daubenton obſerves, that it would be more proper to call it the *declining age*, becauſe nature then becomes retrograde, the fatneſs and good plight of the body diminiſhes, and certain parts of it do not perform their functions with equal vigour.

The age of decline extends from forty or forty-five to ſixty or ſixty-five years of age. At this time of life, the diminution of the fat is the cauſe of thoſe wrinkles which begin to appear in the face and ſome other parts of the body. The ſkin not being ſupported by the ſame quantity of fat, and being incapable, from want of elaſticity, of contracting, ſinks down and forms folds. In the decline of life, a remarkable change takes place alſo in viſion. In the vigour of our days, the chryſtalline lens, being thicker and more diaphanous than the humours of the eye, enables us to read letters of a very ſmall character at the diſtance of eight or ten inches. But when the age of decline comes on, the quantity of the humours of the eye diminiſhes, they loſe their clearneſs, and the tranſparent cornea becomes leſs convex. To remedy this inconvenience we place what we wiſh to read at a greater diſtance from the eye: but viſion is thereby very little improved, becauſe the image of the object becomes ſmaller and more obſcure. Another mark of the decline of life is a weakneſs of the ſtomach, and indigeſtion, in moſt people who do not take ſufficient exerciſe in proportion to the quantity and the quality of their food.

31 Old age.

At ſixty, ſixty-three, or ſixty-five years of age, the ſigns of decline become more and more viſible, and indicate *old age*. This period commonly extends to the age of ſeventy, ſometimes to ſeventy-five, but ſeldom to eighty. When the body is extenuated and bent by old age, man then becomes crazy. Crazineſs therefore is nothing but an *infirm old age*. The eyes and ſtomach then become weaker and weaker; leanneſs increaſes the number of the wrinkles; the beard and the hair become white; the ſtrength and the memory begin to fail.

After ſeventy, or at moſt eighty years of age, the life of man is nothing but labour and ſorrow: Such was the language of David near three thouſand years ago. Some men of ſtrong conſtitutions, and in good health, enjoy old age for a long time without decrepitude; but ſuch inſtances are not very common. The infirmities of decrepitude continually increaſe, and at length death concludes the whole. This fatal term is uncertain. The only concluſions which we can form concerning the duration of life, muſt be derived from obſervations made on a great number of men who were born at the ſame time, and who died at different ages. Theſe we ſhall mention in the ſequel.

The ſigns of decrepitude form a ſtriking picture of weakneſs, and announce the approaching diſſolution of the body. The memory totally fails; the nerves become hard and blunted; deafneſs and blindneſs take place; the ſenſes of ſmell, of touch, and of taſte, are deſtroyed; the appetite fails; the neceſſity of eating, and more frequently that of drinking, are alone felt; after the teeth fall out, maſtication is imperfectly performed, and digeſtion is very bad; the lips fall inwards; the edges of the jaws can no longer approach one another; the muſcles of the lower jaw become ſo weak, that they are unable to raiſe and ſupport it: the body ſinks down; the ſpine is bent outward; and the vertebræ grow together at the anterior part: the body becomes extremely lean; the ſtrength fails: the decrepid wretch is unable to ſupport himſelf; he is obliged to remain on a ſeat, or ſtretched in his bed: the bladder becomes paralytic; the inteſtines loſe their ſpring; the circulation of the blood becomes ſlower; the ſtrokes of the pulſe no longer amount to the number of eighty in a minute as in the vigour of life, but are reduced to twenty-four and ſometimes fewer: reſpiration is ſlower; the body loſes its heat; the circulation of the blood ceaſes; death follows; and the dream of life is no more.

32 Decrepitude and death.

33 Man naturally formed for long life.

Man, ſays Haller in his Phyſiology, has no right to complain of the ſhortneſs of life. Throughout the whole of living beings, there are few who unite in a greater degree all the internal cauſes which tend to prolong its different periods. The term of geſtation is very conſiderable; the rudiments of the teeth are very late in unfolding; his growth is ſlow, and is not completed before about twenty years have elapſed. —The age of puberty, alſo, is much later in man than in any other animal. In ſhort, the parts of his body being compoſed of a ſofter and more flexible ſubſtance, are not ſo ſoon hardened as thoſe of inferior animals. Man, therefore, ſeems to receive at his birth the ſeeds of a long life: if he reaches not the diſtant period which nature ſeemed to promiſe him, it muſt be owing to accidental cauſes foreign to himſelf. Inſtead of ſaying that he has finiſhed his life, we ought rather to ſay that he has not completed it.

The natural and total duration of life is in ſome meaſure proportioned to the period of growth. A tree or an animal which ſoon acquires its full ſize, decays much ſooner than another which continues to grow for a longer time. If it is true that the life of animals is eight times longer than the period of their growth, we might conclude that the boundaries of human life may be extended to a century and a half.

34 Duration of life.

It does not appear that the life of man becomes ſhorter in proportion to the length of time the world has exiſted. In the days of the Pſalmiſt, the ordinary limits of human life did not exceed ſeventy or eighty years. No king of Judah lived beyond that period. When the Romans, however, were numbered by Veſpaſian, there were found in the empire, in that age of effeminacy, ten men aged an hundred and twenty and upwards. Among the princes of modern times, the late Frederic the Great of Pruſſia lived to the age of 74. George II. of Britain lived to that of 77. Louis XIV. lived to the ſame age. Staniſlaus king of Poland and duke of Lorrain exceeded that age. Pope Clement XII. lived to the age of 80. George I. of Britain attained the age of 83. M. Bomare has collected divers inſtances of perſons who lived to the age of 110 and upwards, of which we ſhall in a note (D) ſpecify a few in ſupplement to thoſe already given under the article LONGEVITY.

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35 Remarkable inſtances of longevity.

(D) William Lecomte, a ſhepherd, died ſuddenly in 1776, in the county of Caux in Normandy, at the age of 110. Cramers, phyſician to the emperor, ſaw at Temeſwar two brothers, the one aged 110 and the other 112, both of whom were fathers at that age. Saint Paul the hermit was 113 at his death. The Sieur Iſwan-Horwaths, knight of the order of St Louis, died at Sar-Albe in Lorrain in 1775, aged almoſt 111. He was a great hunter. He undertook a long journey a ſhort time before his death, and performed it on horſeback. Roſine Iwiwarouſka died at Minſk in Lithuania at the age of 113. Fockjel Johannes died at Oldeborn in Frieſland, aged 113 years and 16 days. Marſk Jonas died in the year 1775 at Vilejac in Hungary, aged 119. John Neithen of Bakler in Zeland lived to the age of 120. Elenora Spicer died in 1773, at Accomack in Virginia, aged 121. John Argus was born in the village of Laſtua in Turkey, and died the 6th of March 1779, at the age of 123, having ſix ſons and three daughters, by whom he had poſterity to the fifth generation. They amounted to the number of 160 ſouls, and all lived in the ſame village. His father died at the age of 120. In December 1777, there lived in Devonſhire a farmer named *John Brookey*, who was 134 years of age, and had been fifteen times married. The Philoſophical Tranſactions mention an Engliſhman of the name of *Eccleſton*, who lived to the age of 143. Another Engliſhman of the name of *Effingham*, died in 1757 at the age of 144. Niels Jukens of Hamerſet in Denmark died in 1764, aged 146. Chriſtian Jacob Drakemberg died in 1770 at Archuſen, in the 146th year of his age. This old man of the north was born at Stavangar in Norway in 1624, and at the age of 130 married a widow of 60. In Norway ſome men have lived to the age of 150. John Rovin, who was born at Szatlova-Carantz-Betcher, in the bannat of Temeſwar, lived to the age of 172, and his wife to that of 164, having been married to him during the ſpace of 147 years. When Roven died, their youngeſt ſon was 99 years of age. In the *Gazette de France*, Jan. 18. 1780, we are informed that there lived at that time at Cordova du Tucuman, in Spaniſh America, a negro woman called *Louiſa Trexo*, who, by the judicial teſtimony of ſeveral perſons 100 years old, and of a negro woman of 120, was aged between 174 and 175 years. Peter Zoten, a peaſant, and a countryman of John Rovin, died in 1724 at the age of 185. His youngeſt ſon was then 97 years of age. The hiſtory and whole length pictures of John Rovin, Henry Jenkins, and Peter Zortan, are to be ſeen in the library of S. A. R. prince Charles at Bruſſels. Hanovius, profeſſor at Dantzic, mentions in his nomenclature an old man who died at the age of 184; and another ſtill alive in Wallachia, whoſe age, according to this author, amounts to 186. *Dictionnaire d'Hiſt. Nat.* voce HOMME.

36 Chief cauſes of longevity.

Before we proceed to aſſign the common cauſes of longevity, it is proper to inquire into the manner of life and the ſituation of thoſe by whom it has been enjoyed. We find, then, that thoſe who have lived to the greateſt age have been ſuch as did not attain their full growth till a very advanced period of life, and who have kept their appetites and paſſions under the moſt complete ſubjection. In a word, thoſe who have exceeded 100 years, have in general been robuſt, laborious, ſober, and careful to obſerve the ſtricteſt regimen. Enjoying a good conſtitution from nature, they have ſeldom or never been ſubject to diſeaſe. They have even enjoyed the greateſt health and vigour, and retained the uſe of their ſenſes to the laſt moment of their lives.

Among thoſe who have led a life of contemplation and ſtudy, many have reached a very advanced age. Longevity is frequent among the different orders of religious, who by their ſtatutes are confined to a moderate diet, and obliged to abſtain from wine and the uſe of meat. Some celebrated anchorets have lived to a great age while they fed upon nothing but the wild roots and fruits which they found in the deſert whither they had retired. The philoſopher Xenophilus, who lived to the age of 106, was of the Pythagorean ſect. It is well known, that thoſe philoſophers who held the tranſmigration of ſouls, denied themſelves the uſe of meat, becauſe they imagined that killing an animal would be to aſſaſſinate another ſelf. A country life has produced many ſound and vigorous old men. It is ſuppoſed that a happy old age is attained with greater difficulty in towns than in the country. Sir Hans Sloane, Duverney, and Fontanelle, however, are inſtances of men whoſe lives have been ſpent in cities, and yet extended to a very great length. It has been obſerved, that men deprived of reaſon live very long; and this Dr Haller imputes to their being exempted from thoſe inquietudes which he conſiders as the moſt deadly poiſon. Perſons poſſeſſing a ſufficiently good underſtanding, but deſtitute of ambition, have been found to enjoy very long life. Men who are devoid of pretenſion, who are free from thoſe cares which a deſire of ſhining by a diſplay of talents, or of acquiring dignity and power, neceſſarily brings in its train, who feel no regret for the paſt nor anxiety about the future, are ſtrangers to thoſe torments of the mind which waſte and conſume the body. To that tranquillity of ſoul, which is ſo excellent a prerogative of infancy, they add that of being long young by phyſical conſtitution on which the moral has a ſtriking and powerful influence.

Premature wiſdom, and early talents, are often fitter to excite aſtoniſhment than expectation. The rapid unfolding of the moral faculties, by ſhortening the period of youth, ſeems to diminiſh in proportion the total duration of life. We have known a young lady of ſeventeen, who could ſpeak very correctly ſeven languages: ſhe tranſlated and wrote Latin, Greek, Italian, Spaniſh, German, Engliſh, and French; but ſhe died at the age of eighteen. The young man by whom ſhe was aſked in marriage, having been informed that he could not obtain her hand till he had made himſelf worthy of her by the ſame degree of talents and information, died the ſame year and at the ſame age. But in ſome families, the web of life, to uſe an expreſſion of Haller, ſeems to be better warped than in others: of this kind were the families of *Thomas Parr*, mentioned under LONGEVITY; and *John Argus*, mentioned in the foregoing note.

From the preceding obſervations, Dr Haller has attempted to deduce the cauſes why a few men are longer exempted than others from the common fate.

The circumſtances which oppoſe their influence are independent of our will; ſuch as the ravages of epidemic diſtempers, trouble, and anxiety of mind, which create diſeaſes in the body, or the torments of ambition. It is neceſſary to live in a ſalubrious climate, to enjoy a fortune ſufficiently eaſy to exclude thoſe uneaſy deſires which create a feeling of want and privation, to be deſcended from healthy parents, to avoid drinking wine in youth, to drink water, and to eat little meat and a great deal of vegetables. It is neceſſary alſo to be temperate in meals; moderate in pleaſures, ſtudy, and exerciſe; to be naturally inclined to cheerfulneſs; and to allot a due time to ſleep and repoſe.

37 Cauſes by which the natural tendency to long life is counteracted.

Long life is certainly very rare; but, as has been already obſerved, we muſt diſtinguiſh between what is natural to the conſtitution of man, and that which is the conſequence of his condition. By the former he is made to be long lived; but nature is arreſted in her courſe by local and accidental cauſes, which it is not in our power to avoid.

Let us take a retroſpective view of a man's life from his infancy, and enumerate the chief of theſe different cauſes. Of a thouſand infants, an account of which Dr Haller has extracted from the London bills of mortality, twenty-three died almoſt as ſoon as they came into the world: teething carried of fifty, and convulſions two hundred and ſeventy-ſeven; eighty died of the ſmall pox, and ſeven of the meaſles. Among the adult females, eight at leaſt died in child-bed: conſumption and aſthma, diſeaſes more frequent in England than in France, carried off an hundred and ninety-one of the ſame ſex, and almoſt a fifth part of the full grown men. An hundred and fifty died of fevers. At a more advanced age, twelve died of apoplexy, and forty-one of dropſy, without mentioning thoſe to whom diſeaſes of little importance in themſelves became mortal. There only remained ſeventy-eight whoſe death could be aſcribed to old age; and of theſe twenty-ſeven lived to the age of eighty and upwards. Among the different diſeaſes of which we have juſt now ſeen the fatal effects, and which carry off more than nine-tenths of mankind, not one, it muſt be allowed, is natural to the conſtitution. The inhabitants of Britain are in general but little ſubject to diſeaſes, excepting the ſmall-pox and the meaſles; and many of them enjoy uninterrupted health to old age.

What are the moſt prevalent diſeaſes in other countries, which prove equally fatal to the duration of human life? In northern climates, ſcurvy, the colic of the Laplanders, and diſeaſes of the lungs, moſt frequently occaſion death. In temperate climates, dropſy carries off a great many at the beginning of old age, which is the boundary of life in the greateſt part of both ſexes, when they have eſcaped the acute diſeaſes, ſuch as putrid fever, &c. Acute diſeaſes are moſt common in warm countries. In ſome places, the rays of the ſun kill in a few hours thoſe who are expoſed to its burning heat. The air of Egypt and of Aſia Minor engenders the plague, by which one half their inhabitants are carried off. Between the tropics men are ſubject to dyſenteries and violent fevers. The cold of the night, in warm climates, occaſions ſometimes violent diſeaſes, ſuch as palſy, quinſey, and a ſwelling of the head. Damp and marſhy places give riſe to fevers of a different kind, but alſo very dangerous. The life of ſailors has a great tendency to produce ſcurvy. How many profeſſions prove fatal to the health, and in moſt men haſten that period which nature would have brought on by ſlow degrees! Miners, ſtone-cutters, gilders, perſons employed im emtying privies, &c. are ſubject to diſeaſes of the lungs, and become paralytic. Other profeſſions of life bring on other accidents, of which it would carry us too far to give a particular account. What has been ſaid is ſufficient to ſhow, that it is the dangers with which we are ſurrounded that ſhorten the period of human life.

By examining the liſt of thoſe who have attained a great age, it will be found that mankind are longer lived in northern than in ſouthern countries. It has been obſerved, that there are more old men in mountains and elevated ſituations than in plains and low countries. We repeat it, if the duration of life among the inhabitants of ſouthern climates be compared with the duration of life in northern nations, it will be allowed, that the latter enjoy both longer life and better health than the former. Their growth being retarded by the rigour of the climate, their decay muſt alſo be ſlower, becauſe of the proportion which exiſts between the growth of animals and the length of their lives. Among ten perſons who have lived to the age of an hundred eight or nine will be found to have lived in the north.

38
More women than men attain to old age.

It appears from the bills of mortality, that in the country more boys are born than girls: in cities, on the contrary, the number of females is commonly greateſt. Obſervations made with great care prove, that in moſt countries there are fewer men alive than women, and that more males die, chiefly at the firſt and laſt periods of life. In Sweden, the whole number of females in 1763, was to that of males in the proportion of ten to nine. The number of old women who exceeded 80 years of age, was to that of old men of the ſame age in the proportion to 33 to 19: and there were more women than men who had attained the age of 86, in the proportion of almoſt two to one.

39
Villages more favourable than towns to longevity.

The late Dr Price made obſervations, after Dr Percival, on the difference of longevity, and the duration of human life, in towns, country-pariſhes, and villages; of which the following is the reſult. A greater number in proportion die in great towns than in ſmall ones, and a greater number in the latter than in villages. The cauſe of this difference, which is found to be very great, muſt be, in the firſt place, the luxury and diſſipation which prevail in towns; and, ſecondly, the badneſs of the air. In the town of Mancheſter, according to obſervation, $\frac{1}{28}$ of the inhabitants die annually; whereas, in the neighbouring country, the number of deaths does not exceed $\frac{1}{46}$ of the whole inhabitants. It may be laid down as a general principle, that in great towns, the number of deaths annually is from 1 in 19 to 1 in 22 or 23; in middling towns, from 1 in 24 to 1 in 28; and in country pariſhes and villages ſeldom more than 1 in 40 or 50. In 1763, the number of inhabitants in Stockholm amounted to 72,979. The average number of deaths for the ſix years preceding had been 3802, which makes 1 in 19 annually; while throughout all Sweden, including the towns and the country, not more than 1 in 35 die annually. At Rome the inhabitants are numbered every, year. In 1771 they were found to amount to 159,675; the average number of deaths for ten years was 7367; which makes 1 in 23$\frac{1}{2}$ annually. In London not leſs than 1 in 20$\frac{3}{4}$ of the inhabitants die every year.

40
Probabilities of the duration of life.

M. Daubenton has given in the *Encyceopédie Methodique*, a table of the probabilities of the duration of life, conſtructed from that which is to be found in the ſeventh volume of the *Supplemens a l'Hiſtoire Naturelle de M. de Buffon.*

The following is an abridgment of it:

Of 23,994 children born at the ſame time, there will probably die.

In one year - -	7998
Remaining $\frac{2}{3}$ or 15996.	
In eight years - -	11997
Remaining $\frac{1}{2}$ or 11997.	
In 38 years - -	15996
Remaining $\frac{1}{3}$ or 7998.	
In 50 years -	17994
Remaining $\frac{1}{4}$ or 5998.	
In 61 years - -	19995
Remaining $\frac{1}{6}$ or 3999.	
In 70 years - - -	21595
Remaining $\frac{1}{10}$ or 2399.	
In 80 years - - -	22395
Remaining $\frac{1}{40}$ or 599.	
In 90 years - - -	23914
Remaining $\frac{1}{300}$ or 79.	
In 100 years - - -	23992
Remaining $\frac{1}{10000}$ or 2.	

41
Recapitulation of the different ſtages.

It thus appears, that a very ſmall number of men indeed paſs through all the periods of life, and arrive at the goal marked out by nature. Innumerable cauſes accelerate our diſſolution. The life of man, we have obſerved, conſiſts in the activity and exerciſe of his organs, which grow up and acquire ſtrength during infancy, adoleſcence, and youth. No ſooner has the body attained its utmoſt perfection, than it begins to decline. Its decay is at firſt imperceptible; but in the progreſs of time the membranes become cartilaginous, the cartilages acquire the conſiſtence of bone; the bones become more ſolid, and all the fibres are hardened. Almoſt all the fat waſtes away; the ſkin becomes withered and ſcaly; wrinkles are gradually formed; the hair grows white; the teeth fall out; the face loſes ſhape; the body is bent; and the colour and conſiſtence of the cryſtalline humour become more perceptible. The firſt traces of this decay begin to be perceived at the age of forty, and ſometimes ſooner; this is the *age of decline.* They increaſe by ſlow degrees till ſixty, which is the *period of old age.* They increaſe more rapidly till the age of ſeventy or ſeventy five. At this period *crazineſs* begins, and continues always to increaſe. Next ſucceeds *decrepitude,* when

when the memory is gone, the uſe of the ſenſes loſt, the ſtrength totally annihilated, the organs worn out, and the functions of the body almoſt deſtroyed. Little now remains to be loſt; and before the age of ninety or an hundred, death terminates at once decrepitude and life.

42 Gradual extinction of life.

The body then dies by little and little: its motion gradually diminiſhes; life is extinguiſhed by ſucceſſive gradations, and death is only the laſt term in the ſucceſſion. When the motion of the heart, which continues longeſt, ceaſes, man has then breathed his laſt; he has paſſed from the ſtate of life to the ſtate of death; and as at his birth a breath opened to him the career of life, ſo with a breath he finiſhes his courſe.

43 Natural cauſe of death.

This natural cauſe of death is common to all animals and even to vegetables. We may obſerve that the centre of an oak firſt periſhes and falls into duſt, becauſe theſe parts having become harder and more compact can receive no further nouriſhment. The cauſes of our diſſolution, therefore, are as neceſſary as death is inevitable; and it is no more in our power to retard this fatal term than to alter the eſtabliſhed laws of the univerſe. Hence the following maxim has been univerſally adopted, *Contrà vim mortis, nullum medicamentum in hortis.* In whatever manner death happens, the time and circumſtances thereof are unknown. It is conſidered, however, as at all times terrible, and the very thoughts of it fill the mind with fear and trouble. It is notwithſtanding our duty frequently to direct our thoughts to that event, which muſt inevitably happen, and by a life of virtue and innocence to prepare againſt thoſe conſequences which we ſo much dread.

44 Operates more ſlowly upon women than upon men.

As in women the bones, the cartilages, the muſcles, and every other part of the body, are ſofter and leſs ſolid than thoſe of men, they muſt require more time in hardening to that degree which occaſions death.—Women of courſe ought to live longer than men. This reaſoning is confirmed by experience; for by conſulting the bills of mortality, it appears, that after women have paſſed a certain age, they live much longer than men who have arrived at the ſame age.—In like manner, it is found by experience, that in women the age of youth is ſhorter and happier than in men, but that the period of old age is longer, and attended with more trouble. *Citius pubeſcunt, citius ſeneſcunt.*

45 Diſſolution of the body

After death, the organization of the body begins to be diſſolved, and all the parts relax, corrupt, and ſeparate. This is produced by an inteſtine fermentation, which occaſions putrefaction, and reduces the body to volatile alkali, fetid oil, and earth.

THE other particulars that were propoſed to be noticed in this article are, the ſeveral ſenſes with which man is endowed; his conſtitution, and animal functions; and that variety of colour, form, and character, which he aſſumes in different quarters of the globe. But there is no occaſion to enlarge upon thoſe topics here, as they have been already explained in other parts of the work. For the two firſt, ſee ANATOMY, *paſſim*. The laſt has been partly diſcuſſed under the word COMPLEXION, and will be reſumed afterwards under the article VARIETIES *of the Human Species*. For what regards man, conſidered as a rational, ſocial, moral, and religious being, ſee METAPHYSICS, MORAL *Philoſophy*, RELIGION, and THEOLOGY; alſo SOCIETY, LAW, LANGUAGE, and LOGIC.

ISLE OF MAN, an iſland in the Iriſh ſea, lying about ſeven leagues north from Angleſey, about the ſame diſtance weſt from Lancaſhire, nearly the like diſtance ſouth-eaſt from Galloway, and nine leagues eaſt from Ireland. Its form is long and narrow, ſtretching from the north-eaſt of Ayre-point to the Calf of Man, which lies ſouth-weſt, at leaſt 30 Engliſh miles. Its breadth in ſome places is more than nine miles, in moſt places eight, and in ſome not above five, and contains about 160 ſquare miles.

The firſt author who mentions this iſland is Cæſar; for there can be as little doubt, that, by the *Mona*, of which he ſpeaks in his Commentaries, placing it in the midſt between Britain and Ireland, we are to underſtand Man; as that the *Mona* of Tacitus, which he acquaints us had a fordable ſtrait between it and the continent, can be applied only to Angleſey. Pliny has ſet down both iſlands; *Mona*, by which he intends Angleſey, and *Monabia*, which is Man. In Ptolemy we find *Monaæda*, or *Monaïda*, that is, the farther or more remote Mŏn. Oroſius ſtyles it *Menavia*; tells us, that it was not extremely fertile; and that this, as well as Ireland, was then poſſeſſed by the Scots. Beda, who diſtinguiſhes clearly two Menavian iſlands, names this the *northern Menavia*, beſtowing the epithet of *ſouthern* upon Angleſey. In ſome copies of Nennius, this iſle is denominated *Eubonia*; in others, *Menavia*; but both are explained to mean *Man*. Alured of Beverley alſo ſpeaks of it as one of the Menavian iſlands. The Britons, in their own language, called it *Manaw*, more properly *Main au*, *i. e.* "a little iſland," which ſeems to be latinized in the word *Menavia*. All which clearly proves, that this ſmall iſle was early inhabited, and as well known to the reſt of the world as either Britain or Ireland.

In the cloſe of the firſt century, the Druids, who were the prieſts, prophets, and philoſophers of the old Britons, were finally expelled by Julius Agricola from the ſouthern Mona; and we are told, that they then took ſhelter in the northern. This iſland they found well planted with firs; ſo that they had, in ſome meaſure, what they delighted in moſt, the ſhelter of trees; but, however, not the ſhelter of thoſe trees in which they moſt delighted, viz. the oaks: and therefore theſe they introduced. No hiſtories tell us this; but we learn it from more certain authority, great woods of fir having been diſcovered interred in the bowels of the earth, and here and there ſmall groves of oaks: but as theſe trees are never met with intermixed, ſo it is plain they never grew together; and as the former are by far the moſt numerous, we may preſume them the natural produce of the country, and that the latter were planted and preſerved by the Druids. They gave the people, with whom they lived, and over whom they ruled, a gentle government, wiſe laws, but withal a very ſuperſtitious religion. It is alſo very likely that they hindered them, as much as they could, from having any correſpondence with their neighbours; which is the reaſon that

that, though the iſland is mentioned by ſo many writers, not one of them, before Oroſius, ſays a word about the inhabitants. A little before his time, that is, in the beginning of the fifth century, the Scots had tranſported themſelves thither, it is ſaid, from Ireland. The tradition of the natives of Man (for they have a traditionary hiſtory) begins at this period. They ſtyle this firſt diſcoverer *Mannan Mac Lear;* and they ſay that he was a magician, who kept this country covered with miſts, ſo that the inhabitants of other places could never find it. But the ancient chronicles of Ireland inform us, that the true name of this adventurer was *Orbſenius*, the ſon of Alladius, a prince in their iſland; and that he was ſurnamed *Mannanan*, from his having firſt entered the iſland of Man, and *Mac Lir*, i. e. "the offſpring of the ſea," from his great ſkill in navigation. He promoted commerce; and is ſaid to have given a good reception to St Patrick, by whom the natives were converted to Chriſtianity.

The princes who ruled after him ſeem to have been of the ſame line with the kings of Scotland, with which country they had a great intercourſe, aſſiſting its monarchs in their wars, and having the education of their princes confided to them in time of peace.

In the beginning of the ſeventh century, Edwin king of Northumberland invaded the Menavian iſlands, ravaged Man, and kept it for ſome time, when, Beda aſſures us, there were in it about 300 families: which was leſs than a third part of the people in Angleſey, though Man wants but a third of the ſize of that iſland.

The ſecond line of their princes they derive from Orri, who, they ſay, was the ſon of the king of Norway; and that there were 12 princes of this houſe who governed Man. The old conſtitution, ſettled by the Druids, while they ſwayed the ſceptre, was perfectly reſtored; the country was well cultivated and well peopled; their ſubjects were equally verſed in the exerciſe of arms and in the knowledge of the arts of peace: in a word, they had a conſiderable naval force, an extenſive commerce, and were a great nation, tho' inhabiting only a little iſle. Guttred the ſon of Orri built the caſtle of Ruſſyn, A. D. 960, which is a ſtrong place, a large palace, and has ſubſiſted now above 800 years. Macao, was the ninth of theſe kings, and maintained an unſucceſsful ſtruggle againſt Edgar, who reduced all the little ſovereigns of the different parts of Britain to own him for their lord; and who, upon the ſubmiſſion of Macao, made him his high-admiral, by which title (*archipirata*, in the Latin of thoſe times) he ſubſcribes that monarch's charter to the abbey of Glaſtonbury.

After the death of Edward the Confeſſor, when Harold, who poſſeſſed the crown of England, had defeated the Norwegians at the battle of Stamford, there was amongſt the fugitives one Goddard Crownan, the ſon of Harold the Black, of Iceland, who took ſhelter in the iſle of man. This iſle was then governed by another Goddard, who was a deſcendant from Macao, and he gave him a very kind and friendly reception. Goddard Crownan, during the ſhort ſtay he made in the iſland, perceived that his name-ſake was univerſally hated by his ſubjects; which inſpired him with hopes that he might expel the king, and become maſter of the iſland. This he at laſt accompliſhed, after having defeated and killed Fingal the ſon of Goddard, who had ſucceeded his father. Upon this he aſſigned the north part of the iſland to the natives, and gave the ſouth to his own people; becoming, in virtue of his conqueſt, the founder of their third race of princes. However he might acquire his kingdom, he governed it with ſpirit and prudence; made war with ſucceſs in Ireland; gained ſeveral victories over the Scots in the Iſles; and, making a tour through his new obtained dominions, deceaſed in the iſland of Iſlay. He left behind him three ſons. A civil war breaking out between the two eldeſt, and both of them deceaſing in a few years, Magnus king of Norway coming with a powerful fleet, poſſeſſed himſelf of Man and the iſles, and held them as long as he lived; but being ſlain in Ireland; the people invited home Olave the youngeſt ſon of Goddard Crownan, who had fled to the court of England, and been very honourably treated by Henry the Second. There were in the whole nine princes of this race, who were all of them feudatories to the kings of England; and often reſorted to their court, were very kindly received, and had penſions beſtowed upon them. Henry III. in particular charged Olavo, king of Man, with the defence of the coaſts of England and Ireland; and granted him annually for that ſervice 40 marks, 100 meaſures of wheat, and five pieces of wine. Upon the demiſe of Magnus, the laſt king of this iſle, without heirs male, Alexander III. king of Scots, who had conquered the other iſles, ſeized likewiſe upon this; which as parcel of that kingdom, came into the hands of Edward I. who directed William Huntercumbe, guardian or warden of that iſle for him, to reſtore it to John Baliol, who had done homage to him for the kingdom of Scotland.

But it ſeems there was ſtill remaining a lady named *Auſtrica*, who claimed this ſovereignty, as couſin and neareſt of kin to the deceaſed Magnus. This claimant being able to obtain nothing from John Baliol, applied herſelf next to king Edward, as the ſuperior lord. He, upon this application by his writ, which is yet extant, commanded both parties, in order to determine their right, to appear in the king's-bench. The progreſs of this ſuit does not appear; but we know farther, that this lady, by a deed of gift, conveyed her claim to Sir Simon de Montacute; and, after many diſputes, invaſions by the Scots and other accidents, the title was examined in parliament, in the ſeventh of Edward III. and ſolemnly adjudged to William de Montacute; to whom, by letters-patent, dated the ſame year, that monarch releaſed all claim whatſoever.

In the ſucceeding reign, William Montacute, earl of Saliſbury, ſold it to Sir William Scroop, afterwards earl of Wiltſhire; and upon his looſing his head, it was granted by Henry IV. to Henry Percy, earl of Northumberland; who, being attainted, had, by the grace of that king, all his lands reſtored, except the iſle of Man, which the ſame monarch granted to Sir John Stanley, to be held by him of the king, his heirs and ſucceſſors, by homage, and a caſt of falcons to be preſented at every coronation. Thus it was poſſeſſed by this noble family, who were created earls of Derby, till the reign of queen Elizabeth; when, upon the demiſe of earl Ferdinand, who left three daughters, it was, as lord Coke tells us, adjudged to thoſe ladies, and from them purchaſed by William earl of Derby, the brother of Ferdinand, from whom it was claimed by deſcent, and adjudged to its preſent poſſeſſor, his grace the duke of Athol.

This iſland, from its ſituation directly in the mouth of the channel, is very beneficial to Britain, by leſſening the force of the tides, which would otherwiſe break with greater violence than they do at preſent. It is frequently expoſed to very high winds; and at other times to miſts, which however, are not at all unwholeſome. The ſoil towards the north is dry and ſandy, of conſequence unfertile, but not unimproveable; the mountains, which may include near two-thirds of the iſland, are bleak and barren; yet afford excellent peat, and contain ſeveral kinds of metals. They maintain alſo a kind of ſmall ſwine, called *purrs*, which are eſteemed excellent pork. In the valleys there is as good paſture, hay, and corn, as in any of the northern counties; and the ſouthern part of the iſland is as fine ſoil as can be wiſhed. They have marl and lime-ſtone ſufficient to render even their pooreſt lands fertile; excellent ſlate, rag-ſtone, black marble, and ſome other kinds for building. They have vegetables of all ſorts, and in the utmoſt perfection; potatoes in immenſe quantities; and, where proper pains have been taken, they have tolerable fruit. They have alſo hemp, flax, large crops of oats and barley, and ſome wheat. Hogs, ſheep, goats, black cattle, and horſes, they have in plenty; and, though ſmall in ſize, yet if the country was thoroughly and ſkilfully cultivated, they might improve the breed of all animals, as experience has ſhown. They have rabbits and hares very fat and fine; tame and wild fowl in great plenty; and in their high mountains they have one airy of eagles and two of excellent hawks. Their rivulets furniſh them with ſalmon, trout, eels, and other kinds of freſh-water fiſh; on their coaſts are caught cod, turbot, ling, halibut, all ſorts of ſhell fiſh (oyſters only are ſcarce, but large and good), and herrings of which they made anciently a great profit, though this fiſhery is of late much declined.

The inhabitants of Man, though far from being unmixed, were, perhaps till within the courſe of the preſent century, more ſo than any other under the dominion of the Crown of Great Britain; to which they are very proud of being ſubjects, though, like the inhabitants of Jerſey and Guernſey, they have a conſtitution of their own, and a peculiarity of manners naturally reſulting from a long enjoyment of it.—The Manks tongue is the only one ſpoken by the common people. It is the old Britiſh, mingled with Norſe, or the Norwegian language, and the modern language. The clergy preach and read the common prayer in it. In ancient times they were diſtinguiſhed by their ſtature, courage, and great ſkill in maritime affairs. They are at this day a briſk, lively, hardy, induſtrious, and well meaning people. Their frugality defends them from want: and though there are few that abound, there are as few in diſtreſs; and thoſe that are, meet with a chearful unconſtrained relief. On the other hand, they are choleric, loquacious, and, as the law till lately was cheap, and unincumbered with ſolicitors and attornies, not a little litigious. The revenue, in the earl of Derby's time, amounted to about 2500 l. a-year; from which, deducting his civil liſt, which was about 700 l. the clear income amounted to 1800 l. At the ſame time, the number of his ſubjects was computed at 20,000.—The ſovereign of Man, though he has long ago waved the title of *king*, was ſtill inveſted with regal rights and prerogatives; but the diſtinct juriſdiction of this little ſubordinate royalty, being found inconvenient for the purpoſes of public juſtice, and for the revenue (it affording a commodious aſylum for debtors, outlaws, and ſmugglers), authority was given to the treaſury, by ſtat. 12 Geo. I. c. 28. to purchaſe the intereſt of the then proprietors for the uſe of the crown: which purchaſe was at length completed in the years 1765, and confirmed by ſtat. 5. Geo. III. c. 26. and 39.; whereby the whole iſland and all its dependencies (except the landed property of the Athol family); their manorial rights and emoluments, and the patronage of the biſhopric and other eccleſiaſtical benefices, are unalienably veſted in the crown, and ſubjected to the regulation of the Britiſh exciſe and cuſtoms. The duke, however, is procuring an act of parliament to reviſe the former one.

The moſt general diviſion of this iſland is into north and ſouth; and it contains 17 pariſhes, of which five are market-towns, the reſt villages. Its diviſion with regard to its civil government, is into ſix ſheedings, every one having its proper coroner, who is in the nature of a ſheriff, is intruſted with the peace of his diſtrict, ſecures criminals, brings them to juſtice, &c. The lord chief-juſtice Coke ſays, "their laws were ſuch as ſcarce to be found any where elſe." In July 1786, a copper coinage for the uſe of the iſland was iſſued from the Tower of London. There is a ridge of mountains runs almoſt the length of the iſle, from whence they have abundance of good water from the rivulets and ſprings; and Snafield, the higheſt, riſes about 580 yards. The air is ſharp and cold in winter, the froſts ſhort, and the ſnow, eſpecially near the ſea, lies not long on the ground. Here are quarries of good ſtone, rocks of lime-ſtone, and red free-ſtone, and good ſlate, with ſome mines of lead, copper, and iron. The trade of this iſland was very great before the year 1726; but the late lord Derby farming out his cuſtoms to foreigners, the inſolence of theſe farmers drew on them the reſentment of the government of England, who, by an act of parliament, deprived the inhabitants of an open trade with the kingdom. This naturally introduced a clandeſtine commerce, which they carried on with England and Ireland with prodigious ſucceſs, and an immenſe quantity of foreign goods was run into both kingdoms, till the government in 1765 thought proper to put an entire ſtop to it, by purchaſing the iſland of the duke of Athol, as already mentioned, and permitting a free trade with England. On the little iſle of Pele, on the weſt ſide of Man is a town of the ſame name, with a fortified caſtle. Before the ſouth promontory of Man, is a little iſland called the *Calf of Man*: it is about three miles in circuit, and ſeparated from Man by a channel about two furlongs broad. At one time of the year it abounds with puffins, and alſo with a ſpecies of ducks and drakes, by the Engliſh called *barnacles*, and by the Scots *clakes* and *Soland geeſe*.

The inhabitants of this iſle are of the church of England; and the biſhop is ſtyled *Biſhop of Sodor and Man*. This biſhopric was firſt erected by Pope Gregory IV. and for its dioceſe had this iſle and all the Hebrides, or weſtern iſlands of Scotland; but which were called *Sodoroc* by the Danes, who went to them by the north, from the Swediſh Sodor, Sail or Oar iſlands, from which the title of the biſhop of Sodor is ſuppoſed to originate. The biſhop's ſeat was at Ruſhin, or Caſtle town in the iſle of Man, and in Latin is entitled *Sodorenſis*. But when this iſland became dependent upon the kingdom of England, the Weſtern iſlands withdrew themſelves from the obedience of their biſhop and had a biſhop of their own, whom they entitled alſo *Sodorenſis*, but commonly *Biſhop of the Iſles*. The patronage of the biſhopric was given together with the iſland, to the Stanleys by king Edward IV. and came by an heir-female to the family of Athole; and, on a vacancy thereof, they nominated their deſigned biſhop to the king, who diſmiſſed him to the archbiſhop of York for conſecration.—By an act of parliament, the 33d of king Henry VIII. this biſhopric is declared in the province of York.

Man-of-war Bird. See PELICANUS.

MANAGE. See MANEGE.

MANNASSEH (in Scripture hiſt.), the eldeſt ſon of Joſeph, and grandſon of the patriarch Jacob (Gen. xli. 50, 51.) was born in the year of the world 2290, before Jeſus Chriſt 1714.

The tribe deſcended from him came out of Egypt, in number 32,200 men, fit for battle, upwards of 20 years old, under the conduct of Gamaliel ſon of Pedahzur (Numb. ii. 20, 21.) This tribe was divided at their entrance into the land of Promiſe. One half had its portion beyond the river Jordan, and the other half on this ſide the river. The half tribe of Manaſſeh which ſettled beyond the river poſſeſſed the country of Baſhan, from the river Jabbok to mount Libanus, (Numb. xxii. 33, 34, &c.;) and the other half tribe of Manaſſeh on this ſide Jordan, obtained for its inheritance the country between the tribe of Ephraim to the South, and the tribe of Iſſachar to the north, having the river Jordan to the eaſt, and the Mediterranean ſea to the weſt, (Joſh. xvi. xvii.)

MANASSEH, the 15th king of Judah, being the ſon and ſucceſſor of Hezekiah. His acts are recorded in 2 Kings xx. xxi. and 2 Chr. xxxiii.

MANATI, in zoology. See TRICHECUS.

MANCA, was a ſquare piece of gold coin, commonly valued at 30 pence; and *mancuſa* was as much as a mark of ſilver, having its name *manu-cuſa*, being coined with the hand: (*Leg. Canut.*) But the *manca* and *mancuſa* were not always of that value; for ſometimes the former was valued at ſix ſhillings, and the latter, as uſed by the Engliſh Saxons, was equal in value to 2s. 6d. ſterling. Manca *ſex ſolidis æſtemetur* (Leg. H. 1. c. 69.) Thorn, in his chronicle, tells us, that mancuſa *eſt pondus duorum ſolidorum et ſex denariorum*; and with him agrees Du Cange, who ſays, that 20 *mancæ* make 50 ſhillings. *Manca* and *mancuſa* are promiſcuouſly uſed in the old books for the ſame money.

MANCHA, a territory of Spain in the province of New Caſtile, lying between the river Guadiana and Andaluſia. It is a mountainous country; and it was here that the famous Don Quixote was ſuppoſed to perform his exploits.

MANCHESTER, a town of Lancaſhire in England, ſituated in W. Long. 2. 42. N. Lat. 53. 27. Mr Whitaker conjectures, that the ſtation was firſt occupied by the Britons about 500 years B. C. but that it did not receive any thing like the form of a town till 450 years after, or 50 years B. C. when the Britons of Cheſhire made an irruption into the territories of their ſouthern neighbours, and of conſequence alarmed the Seſtuntii, or inhabitants of Lancaſhire, ſo much that they begun to build fortreſſes, in order to defend their country. Its Britiſh name was *Mancenion*, that is, "a place of tents:" it was changed, however, into *Mancunium* by the Romans who conquered it under Agricola in the memorable year of the Chriſtian æra 79. It appears alſo to have been called *Manduesuedum*, *Mandueſſedum*, *Menucium*, and *Mamceſtre*; from which laſt it ſeems moſt evident that the preſent name has been derived. It is diſtant from London 182 miles, and from Edinburgh 214; ſtanding near the conflux of the Irk and the Irwell, about three miles from the Merſey.

Mancheſter was accounted a large and populous town even 50 years ago; but ſince that time it is ſuppoſed to have increaſed in more than a triple proportion, both in reſpect to buildings and inhabitants. The houſes amount to a number not far ſhort of 12000; and perhaps it may not be an overrate to reckon ſeven perſons to each when it is conſidered, that of the houſes occupied by working people of various deſcriptions, many have two, three, and ſometimes more, families in each. For though many hundred houſes have been built in the courſe of a few late years, yet are they conſtantly engaged as ſoon as poſſible; the avidity for building increaſing with every new acceſſion of inhabitants, and rents riſing to a degree ſcarcely known in other places. The progreſs of this οικομανια may be partly eſtimated by the price of building, land, and materials; a guinea per ſquare yard, chief rent, having been refuſed for ſome central plots; and bricks ſelling at 24s. per 1000, which about four years ſince were not more than half the price. Such, however, has been the happy concurrence of ingenuity and induſtry, and ſuch the aſtoniſhing improvements daily making in its numerous manufactures, together with the encouragement theſe afford to ſkilful artiſts in various branches, that ſtreets muſt extend in proportion: yet population appears to have increaſed more rapidly than buildings; hence competitions naturally ariſe, and hence a *temporary* advance of rents. The manufactures of this town and neighbourhood, from humble domeſtic beginnings about two centuries ago, have now, after progreſſive improvements, acquired ſuch celebrity, both in the ſcale of ornament and utility, as to ſpread in ten thouſand forms and colours, not only in Great Britain, but over all Europe, and even into the diſtant continents; being at once moſt precious mines of well-earned private wealth, and important contributors to the neceſſary public treaſure of the ſtate. Its poſt-office alone may afford an evidence of its extenſive commerce. The population of the town may be further calculated from the great number of cotton factories within the boundaries of the town, wherein it is thought that 20,000 men, women, and children, are employed in the mere branches of preparing *warp* and *weft*. If to theſe be added the many hands applied to weaving, &c. &c. &c. beſide all the more general mechanics, as well as houſeholders, domeſtic ſervants, &c. Mancheſter may be ranked as the moſt populous market-town in Great Britain. The marriages in Mancheſter and Salford, from January 1791 to January 1792, were 1302, the chriſtenings 2960, and the burials 2286. Hence, ſhould it be computed that one in every 30 perſons died, the number of inhabitants would amount to 68,580, which is thought to be much under the ſum of an actual enumeration. The ſtreets are about 600, many of them ſpacious and airy, great part of the old buildings being removed, and the new ſtreets allowed a convenient breadth. The town is now lighted every night by 2000 lamps, and guarded by nearly 200 watchmen.

The college here was founded in 1422 by *Thomas Weſt* Lord Delaware; and conſiſted of a warden, eight fellows, four clerks, and ſix choriſters. About the ſame time the preſent collegiate church was built (timber only having been uſed for the former church); and John Huntington bachelor of laws was the firſt warden, named by the founder himſelf; he enjoyed the wardenſhip nearly 40 years; and a monument juſtly remains to his memory, he having been the firſt to propoſe and aſſiſt in the erection of the church. He died Nov. 11. 1458, and was interred in the middle of the choir. This church is a fine ſtructure of what is termed the Gothic ſyſtem, and is more enriched with ſculpture than ſuch churches uſually are. The tabernacle work over the ſtalls in the choir is very curious, as are the large arches added upon vaulting the choir. The organ, which coſt not leſs than L.1000 is large and powerful. The laſt warden was Richard Murray, D. D. the 14th in ſucceſſion. The college was new-founded in 1636; and Richard Heyrick, B. D. named the firſt warden on that foundation. The preſent warden, Richard Aſheton, D. D. rector of Middleton, is the fifth in ſucceſſion from Richard Heyrick. The collegiate body now conſiſts of a warden, four fellows, two chaplains, two clerks (one of whom, by a very late regulation, is to be at leaſt bachelor of arts and in prieſt's orders), four choriſters, and four ſinging men.

Beſide the collegiate church, there are alſo the following. St Anne's, a handſome church, begun in 1709 and finiſhed in 1723: it is in the gift of the Biſhop of Cheſter. St Mary's, built by the clergy of the collegiate church, and conſecrated upwards of 30 years ago, is a neat and indeed an elegant edifice; as is St John's, which was built about 20 years ſince by the late Edward Byrom, Eſq. The next repreſentation thereof is, by act of parliament, veſted in his heirs, afterwards devolving to the warden and fellows of the collegiate church. St Paul's church was erected upwards of 12 years ago; and is a handſome ſpacious building, chiefly brick; to which has been added, within the laſt two years, a lofty and ſubſtantial ſtone tower. St James's church has been finiſhed within the laſt ten years: it is a large well-lighted building of brick and ſtone, with a ſmall ſtone ſteeple. St Michael's is alſo of brick and ſtone, with a ſquare tower. It was built by the late Rev. Humphrey Owen (one of the chaplains of the collegiate church, and rector of St Mary's), in whoſe heirs the preſentation is veſted for a term of 60 years, and thenceforward in the warden and fellows of the college. To theſe may be added, St Thomas's Ardwick Green: and Trinity church, Salford: for though the Irwell intervenes between Mancheſter and Salford, and each is governed by its reſpective conſtables; yet, being connected by three bridges, by mutual friendſhip, and by the common purſuit of univerſally uſeful manufactures and commerce, the two places are generally conſidered under the name of *Mancheſter*, as the borough of Southwark is not improperly deemed a part of the metropolis. In Salford there is likewiſe a Methodiſt chapel nearly finiſhed. A new church is alſo about to be built and dedicated to St Stephen.—In Mancheſter a new church is lately finiſhed, and called *St George's*; but divine ſervice has not yet been performed therein. St Peter's church, at the end of Moſley-ſtreet, was begun about three years ſince: when finiſhed, it will be a ſtrong and elegant ſtone ſtructure with a high ſpire; at preſent the body only is completed, and lighted, in a manner not very common, by ſix ſemicircular windows. The foundation of another church, to be called *St Clement's*, has alſo been laid, within the year 1792 in Stephenſon's ſquare lately planned; and alſo one called the *New Jeruſalem Church*, nearly finiſhed. Beſide the 14 churches above enumerated, there are, a Catholic chapel, a large Methodiſt chapel, a chapel for the people called Quakers, and 5 chapels for diſſenters of other denominations.

Cheetham's Hoſpital, commonly called the College, becauſe it was originally the place of reſidence of the warden and fellows, is deſerving of particular notice. Humphrey Cheetham of Clayton near Mancheſter, Eſq; having been remarkably ſucceſsful in trade in the middle of the laſt century, bought the college, and liberally endowed it for the maintenance and education of 40 poor boys, admiſſible between the age of 6 and 10 years. By an improvement of the funds of the charity, the numbers of boys was increaſed to 60; and continued ſuch till the Eaſter meeting of the foeffees in 1780, when another augmentation took place, and the number has ſince been conſtantly 80. The townſhips, pointed out by the founder for objects of his charity, are the following, together with the reſpective numbers admitted from each: Mancheſter, original number 14, now 28; Salford 6, now 12; Droylſden 3, now 6; Crumpſall 2, now 4; Bolton-le-moors 10, now 20; Turton 5, now 10. So that 89 perſons are now annually provided for by this liberal benefactor; including for the hoſpital a governor, 1 man and 5 women ſervants; a ſchool-maſter; and, on the library eſtabliſhment, a librarian (See an authentic letter in the *Gent. Mag*, for June 1792, p. 521.) The boys of this hoſpital are comfortably provided for till the age of 14, when they are further clothed, and with a premium placed apprentices to uſeful trades; and, in order to incite early

early habits of induſtry, to make them good ſervants, and at length good maſters, it has been ſuggeſted to furniſh ſome kind of eaſy employment for a ſmall part of their time not engaged at ſchool. The Library which occupies an extenſive gallery of the ſame building, owes its foundation and increaſing importance to the ſame benevolent ſource. The annual value of the fund originally bequeathed for the purchaſe of books and for a librarian's ſalary was 116 l.; but, by recent improvements of the eſtate, the income is more than thrice that ſum. The books at this time amount to 10,000 volumes, of which a catalogue handſomely printed in 2 volumes 8vo, has been publiſhed by the preſent librarian, the Rev. John Radcliffe, A. M. At ſtated hours, on all days, except Sundays and other holidays, the ſtudious may have free acceſs to read, *in the library*, any book it contains; and in order to render it comfortable during the cold ſeaſon of the year, ſeveral ſtoves are kept heated at the reading hours. This college and a large incloſed area are ſituated upon a high perpendicular rock, bounded by the Irk cloſe to its confluence with the Irwell; and is thought by Mr Whitaker to be included, as well as the collegiate church, within the boundaries of the ancient Roman prætorium; the whole of which ſite towards the Irwell, as on the ſide of the Irk, is conſiderably elevated above the water and the oppoſite land of Salford. The Free-ſchool, higher up on the ſame ſide the Irk, almoſt joining to the college, is ſupported by the rents of three mills; one of which is for grinding malt, another for corn, and the third is employed as a ſnuff-mill. Theſe rents are now increaſed to 700 l. *per annum*, for which ſalaries are paid to three maſters and two aſſiſtants. The ſcholars educated here have certain exhibitions allowed at the univerſity; and ſuch of them as are entered at Brazen-noſe college Oxford, have a chance of obtaining ſome valuable exhibitions ariſing from lands in Mancheſter bequeathed by Mr Hulme. The deſerved reputation of this ſchool is a powerful recommendation of its ſcholars entering at the univerſities. The Academy is a large and commodious building, raiſed by the ſubſcriptions of ſeveral reſpectable diſſenters, and placed under the care of able tutors. Here youth above 14 years of age are admitted and inſtructed in the various branches of liberal knowledge, preparatory to trade or the profeſſions. The Literary and Philoſophical Society of Mancheſter was inſtituted in the beginning of the year 1781, and is well known by its Memoirs, of which three volumes 8vo have been publiſhed; theſe have been tranſlated into the German language. A fourth volume is now in the preſs, and in all probability will be publiſhed in the ſpring of 1793. A ſociety was eſtabliſhed here in November 1789, under the name of the *Lancaſhire Humane Society*, for the encouragement of all who may attempt the recovery of perſons apparently drowned. The Infirmary, Diſpenſary, Lunatic Aſylum, and public Baths, are all ſituated on one large airy plot of land, in the moſt elevated and agreeable part of the town; a pleaſant graſs-plot and gravel-walk extending the whole length of the buildings; a canal intervening between them and the public ſtreet, next to which it is guarded by iron paliſades. The Lying-in-hoſpital is ſituated in Salford, at the end of the old bridge. A new Work-houſe is nearly completed; and for ſuch a purpoſe a happier ſpot could not be found in any town than that whereon it is erected, being on an equal eminence with the college on the oppoſite ſide of the Irk, and promiſing the greateſt poſſible comforts to ſuch as may be neceſſitated to become its inhabitants. The exchange was a ſtrong good building; but ſince the late act of parliament obtained for farther improvements of the town, it has been ſold and taken down, and its ſite formed into a convenient area, to the great advantage of the ſurounding houſes. The Theatre is a neat building, wherein the boxes are placed in a ſemicircle oppoſite to the ſtage. The Gentlemens Concert-room is an elegant building, capacious enough to accommodate 1200 perſons. The concerts are ſupported by annual ſubſcriptions: but ſtrangers and military gentlemen have free admiſſion to the private concerts; as alſo to the public, concerts, with a ſubſcriber's ticket. The new Aſſembly-rooms are large and commodious. A Circus is almoſt finiſhed. Here are two Market-places, the old and the new; which are well ſupplied with every thing in ſeaſon, though at high rates. There are ſeveral charity-ſchools belonging to different churches and chapels, where children are furniſhed with clothes and taught to read. The Sunday-ſchools are numerous, and afford inſtruction to upwards of 5000 children.

Over the Irwell are three bridges, uniting the town with Salford: the old bridge is very high at the Mancheſter end, whence it ſlopes into Salford. The middle bridge, four feet wide, raiſed upon timber and flagged, is only for accommodation of foot-paſſengers, who from the Mancheſter ſide muſt deſcend to it by nearly forty ſteps. The lower bridge is a handſome ſtone building of two arches; this bridge affords a level road for two or three carriages abreaſt. It was undertaken and finiſhed by the private ſubſcription of a few gentlemen; and a ſmall toll is taken for all paſſing, which toll is now annually let by auction, and pays the proprietors remarkably well.—From Mancheſter there are likewiſe the ſame number of bridges over the Irk; only one, however, is adapted for the paſſage of carriages. The Irwell, having at a great expence been rendered navigable for veſſels of 20 or 30 tons, burden, there is a conſtant communication between Liverpool, Mancheſter, and the intermediate places on the Irwell and Merſey, to the great advantage of the proprietors and the country at large. This navigation, and more eſpecially the duke of Bridgewater's canal, opening a paſſage from Mancheſter to the Merſey at 30 miles diſtance, have, together, greatly contributed to the preſent highly flouriſhing ſtate of the town. Advantages ſtill greater, becauſe more widely diffuſive, may reſult from the intended union of the Humber and the Merſey by means of canals. Indeed, every mile of canal would benefit many miles of land; and ſuch would be the reciprocity of intereſt, that it would undoubtedly extend and be felt far beyond the viſible meaſurement of the navigation.

We muſt not omit to notice the new penitentiary houſe, called the *New Bailey*, for ſeparate confinement of various criminals. Over the entrance is a large ſeſſion-room, with adjoining rooms for the magiſtrates, council, jurors, &c. Beyond this, in the centre of a very large area incloſed by very high walls, ſtands the Priſon, an extenſive building, forming a croſs three ſtories high; and the four wards of each ſtory may in an inſtant be ſeen by any perſon in its centre. This priſon is kept ſurpriſingly neat and healthy; and ſuch as can work at any trade, and are not confined for crimes of the greateſt magnitude, are employed in a variety of branches: ſo that one may be ſeen beating and cleanſing cotton, another carding it, another roving, and a fourth ſpinning. In the next place may be obſerved a man or a woman buſy at the loom; and in another, one or more engaged in cutting and raiſing the velvet pile. Hence induſtry is not ſuffered to ſlumber in the ſolitary cell, nor to quit it under the acquired impreſſions of that torpor which formerly accompanied the emancipated priſoner from his dungeon; rendering him, perhaps, totally unfit for the duties of honeſt ſociety, though well qualified, in all probability, to hoard with gamblers, and be then, if not before, initiated into their pernicious myſteries.—At Kerſal-moor, three miles diſtant, horſeraces are annually permitted. The banks of the rivers and various brooks about the town afford excellent ſituations for the numerous dye-houſes employed for a multitude of fabrics. Among other things, the manufacture and finiſhing of hats is carried on to an extent of great importance.—The general market is here on Saturdays. Tueſday's market is chiefly for tranſacting buſineſs between the traders and manufacturers of the town and circumjacent country. The fairs are on Whit-Monday, October 1ſt, and November 17th.

Mancheſter is a manor with courts leet and baron. It ſends no members to parliament, but gives title to a duke. The annual fall of rain is here about 42 inches; though from January 1791 to January 1792 it was 44 inches. The ſun's greateſt heat 1791 was 76°, July 17.

MANCHINEEL. See See HIPPOMANE.

MANCIPATIO, was a term made uſe of in the Roman law, and may be thus explained: every father had ſuch a regal authority over his ſon, that before the ſon could be releaſed from his ſubjection and made free, he muſt be three times over ſold and bought, his natural father being the vender. The vendee was called *pater fiduciarius*. After this fictitious bargain, the *pater fiduciarius* ſold him again to the natural father, who could then, but not till then, *manumit* or make him free. The imaginary ſale was called *mancipatio*; and the act of giving liberty or ſetting him free after this was called *emancipatio*.

EMANCIPATIO alſo ſignifies the ſelling or alienating of certain lands by the balance, or money paid by weight, and five witneſſes. This mode of alienation took place only amongſt Roman citizens, and that only in reſpect to certain eſtates ſituated in Italy, which were called *mancipia*.

MANCIPLE (*manceps*), a clerk of the kitchen or caterer. An officer in the inner temple was anciently ſo called, who is now the ſteward there; of whom Chaucer, the ancient Engiſh poet, ſome time a ſtudent of that houſe, thus writes:

> A manciple there was within the temple,
> Of which all caterers might take enſample.

This officer ſtill remains in colleges in the univerſites.

MANDUNIUM, (anc. geog.), a town of the brigantes in Britain. Now *Mancheſter* in Lancaſhire

MANCUS (formed of *manu cuſus*), in antiquity, an Anglo-Saxon gold coin, equal in value to 2½ ſolidii, or 30 pence; and in weight to 55 Troy grains. The firſt account of this coin that occurs in the hiſtory of England, is about the cloſe of the 8th century, in an embaſſy of Cenwulf king of Mercia to Leo III. requeſting the reſtoration of the juriſdiction of the ſee of Canterbury: this embaſſy was enforced by a preſent of 120 mancuſes. Ethelwolf alſo ſent yearly to Rome 300 mancuſes: and theſe coins are ſaid to have continued in ſome form or other till towards the concluſion of the Saxon government. The heriots of the nobility are chiefly eſtimated by this ſtandard in Canute's laws. It came originally from Italy, where it was called *ducat*: and is ſuppoſed to have been the ſame with the drachma or miliarenſis current in the Byzantine empire.

MANDAMUS, in law, a right that iſſues out of the court of king's-bench, ſent to a corporation, commanding them to admit or reſtore a perſon to his office. This writ alſo lies where juſtices of the peace refuſe to admit a perſon to take the oaths in order to qualify himſelf for enjoying any poſt or office: or where a biſhop or archdeacon refuſes to grant a probate of a will, to admit an executor to prove it, or to ſwear a church-warden, &c.

MANDANES, an Indian prince and philoſopher, who for the renown of his wiſdom was invited by the ambaſſadors of Alexander the Great to the banquet of the ſon of Jupiter. A reward was promiſed him if he obeyed, but he was threatened with puniſhment in caſe of a refuſal. Unmoved by promiſes and threatenings, the philoſopher diſmiſſed them with obſerving, that though Alexander ruled over a great part of the univerſe, he was not the ſon of Jupiter; and that he gave himſelf no trouble about the preſents of a man who poſſeſſed not wherewithal to content himſelf. "I deſpiſe his threats (added he): if I live, India is ſufficient for my ſubſiſtence; and to me death has no terrors, for it will only be an exchange of old age and infirmity for the happineſs of a better life."

MANDARINS, a name given to the magiſtrates and governors of provinces in China who are choſen out of the moſt learned men, and whoſe government is always at a great diſtance from the place of their birth.—*Mandarin* is alſo a name given by the Chineſe to the learned language of the country; for beſides the language peculiar to every province, there is one common to all the learned in the empire, which is in China what Latin is in Europe; this is called the *mandarin tongue*, or the *language of the court*.

MANDATE, in law, a judicial commandment to do ſomething. See the article MANDAMUS.

MANDATE, in the canon law, a reſcript of the pope commanding an ordinary collator to put the perſon therein named in poſſeſſion of the firſt vacant benefice in his collation.

MANDATUM, was a fee or retainer given by the Romans to the *procurator* and *advocati*. The *mandatum* was a neceſſary condition, without which they had not the liberty of pleading. Thus the legal eloquence of Rome, like that of our own country, could not be unlocked without a golden key.

MANDERSCHEIT, a town of Germany in the circle

circle of the Lower Rhine, and in the electorate of Triers, capital of a county of the ſame name, between the dioceſe of Triers and the duchy of Juliers. E Long. 6. 32. N. Lat. 50. 20.

MANDEVILLE (Sir John), a phyſician, famous for his travels, was born at St Alban's, about the beginning of the 14th century. He had a liberal education, and applied himſelf to the ſtudy of phyſic; but being at length ſeized with an invincible deſire of ſeeing diſtant parts of the globe, he left England in 1332, and did not return till 34 years after. His friends, who had long ſuppoſed him dead, did not know him when he appeared. He had travelled through almoſt all the eaſt, and made himſelf maſter of a great variety of languages. He particularly viſited Scythia, Armenia the Greater and Leſs, Egypt, Arabia, Syria, Media, Meſopotamia, Perſia, Chaldea, Greece, Dalmatia, &c. His rambling diſpoſition did not ſuffer him to reſt: for he left his own country a ſecond time, and died at Liege in the Netherlands in 1372. He wrote An Itinerary, or an account of his Travels, in Engliſh, French, and Latin.

MANDEVILLO (Bernard de), an eminent writer in the 18th century, was born in Holland, where he ſtudied phyſic, and took the degree of doctor in that faculty. He afterwards came over into England, and in 1714 publiſhed a poem, intitled, "The Grumbling Hive, or Knaves turned Honeſt;" upon which he afterwards wrote remarks, and publiſhed the whole at London, 1723, in 8vo, under the title of, "The Fable of the Bees, or private Vice made public Benefits; with an eſſay on Charity and Charity-ſchools, and a Search into the Nature of Society." This book was preſented by the jury of Middleſex in July the ſame year, and ſeverely animadverted upon in "A Letter to the Right Honourable Lord C." printed in the London Journal of Saturday July 27, 1723. Our author publiſhed a Vindication. His book was attacked by ſeveral writers. He publiſhed other pieces, and died in 1724.

MANDRAGORA, in botany. See Atropa.

MANDRAKE, in botany. See Atropa and Musa.

MANDREL, a kind of wooden pulley, making a member of the turner's lathe. Of theſe there are ſeveral kinds; as *Flat mandrels*, which have three or more little pegs or points near the verge, and are uſed for turning flat boards on. *Pin Mandrels*, which have a long wooden ſhank to fit into a round hole made in the work to be turned. *Hollow Mandrels*, which are hollow of themſelves. and uſed for turning hollow work. *Screw mandrels*, for turning ſcrews, &c.

MANE, the hair hanging down from a horſe's neck; which ſhould be long, thin, and fine; and if frizzled, ſo much the better.

MANEGE, or Manage, the exerciſe of riding the great horſe; or the ground ſet apart for that purpoſe; which is ſometimes covered, for continuing the exerciſe in bad weather; and ſometimes open, in order to give more liberty and freedom both to the horſeman and horſe. See Horsemanship.

The word is borrowed from the French *manage*, and that from the Italian *maneggio*; or, as ſome will have it, *a manu agendo*, "acting with the hand."

MANES, a poetical term, ſignifying the ſhades or ſouls of the deceaſed. The heathens uſed a variety of ceremonies and ſacrifices to appeaſe the manes of thoſe who were deprived of burial. See Lemures and Lemuria.

Dii Manes were the ſame with *inferi*, or the infernal gods, who tormented men; and to theſe the heathens offered ſacrifices to aſſuage their indignation.

The heathen theology is a little obſcure with regard to theſe gods manes. Some hold, that they were the ſouls of the dead; others, that they were the genii of men; which laſt opinion ſuits beſt with the etymology of the word.

The heathens, it is pretty evident, uſed the word *manes* in ſeveral ſenſes; ſo that it ſometimes ſignified the ghoſts of the departed, and ſometimes the infernal or ſubterraneous deities, and in general all divinities that preſided over tombs.

The evocation of the manes of the dead ſeems to have been very frequent among the Theſſalians; but it was expreſsly prohibited by the Romans. See Lares.

Manes, the founder of the Manichæan ſyſtem. See Manichees.

MANETHO, an ancient Egyptian hiſtorian, who pretended to take all his accounts from the ſacred inſcriptions on the pillars of Hermes Triſmegiſtus. He was high prieſt of Heliopolis in the time of Ptolemy Philadelphus, at whoſe requeſt he wrote his hiſtory in Greek; beginning from their gods, and continuing it down to near the time of Darius Codomannus who was conquered by Alexander the Great. His hiſtory of Egypt is a celebrated work, that is often quoted by Joſephus and other ancient authors. Julius Africanus gave an abridgment of it in his Chronology. Manetho's work is however loſt: and there only remain ſome fragments extracted from Julius Africanus, which are to be found in Euſebius's Chronica.

MANFREDI (Euſtachio), a celebrated mathematician, born at Bologna in 1674, where he was elected mathematical profeſſor in 1698. He was made a member of ſeveral academies, and acquired great reputation by his Ephemerides, 4 vols 4to, as well as by other works. He died in 1739.

MANFREDONIA, a port town of Naples, on the Gulph of Venice, which aroſe on the ruins of the ancient Sipontum; (See the article Sipontum). It received its name from its founder *Manfred*; who tranſplanted hither the few inhabitants that remained at Sipontum, and attracted other ſettlers to it by various privileges. and exemptions. In order to found it under the moſt favourable auſpices. he called together all the famous profeſſors of aſtrology (a ſcience in which both he and his father placed great confidence), and cauſed them to calculate the happieſt hour and minute for laying the firſt ſtone. He himſelf drew the plans, traced the walls and ſtreets, ſuperintended the works, and by his preſence and largeſſes animated the workmen to finiſh them in a very ſhort ſpace of time. The port was ſecured from ſtorms by a pier, the ramparts were built of the moſt ſolid materials, and in the great tower was placed a bell of ſo conſiderable a volume as to be heard over all the plain of Capitanata, in order to alarm the country in caſe of an invaſion. Charles of Anjou afterwards removed the bell to Bari, and offered it at the ſhrine of St Nicholas, as a thankſgiving for the recovery of one of his children. In ſpite of all the precautions taken by Manfred to ſecure a brilliant deſtiny to his new city, neither his pains, nor the horoſcopes of his wizards, have been able to render it opulent or powerful. At preſent, Mr Swinburn informs us, it ſcarce muſters ſix thouſand inhabitants, though moſt of the corn exported from the province is ſhipped off here, and a direct trade carried on with Venice and Greece, for which reaſon there is a lazaretto eſtabliſhed : but from ſome late inſtances we may gather, that if the kingdom of Naples has for many years paſt remained free from the plague, it is more owing to good luck, and the very trifling communication with Turkey, than to the vigilance or incorruptibility of the officers of this port. In 1620, the Turks landed and pillaged Manfredonia. All ſorts of vegetables abound here, for flavour and ſucculency infinitely ſuperior to thoſe raiſed by continual waterings in the cineritious ſoil of Naples. Lettuce in particular is delicious, and fiſh plentiful and cheap.

MANGANESE, or **MAGNESIA NIGRA**, a dark-coloured mineral employed in glaſs-works for purifying the glaſs, by taking away the colour it has already, or by ſuperadding a new colour to it. It is alſo uſed in the glazing of earthen ware, where it communicates a black colour. From its property of rendering glaſs colourleſs, it has ſometimes been called the ſoap of glaſs.

This ſubſtance, commonly called *black* or *glaſs-maker's* manganeſe, is ſcarcely any other thing than the calx of a new ſemimetal, whoſe properties were for the firſt time inveſtigated by Mr Scheele in the Stockholm Memoirs for 1774 : afterwards it was more fully inveſtigated by Dr Gahn, and lately by ſeveral other chemiſts. Its colour is of a duſky white ; and the ſurface is uneven and irregular, owing to its imperfect fuſion. It is bright and ſhining when firſt broken, but tarniſhes by expoſure to air much ſooner than any other metallic ſubſtance. Its ſpecific gravity is 6.850 : it equals, if it does not exceed, iron in hardneſs as well as difficulty of fuſion. When reduced to powder, it becomes magnetical, though large pieces of it are not ſo. When expoſed to the air, it ſoon crumbles into a blackiſh brown powder, ſomewhat heavier than the regulus itſelf ; and this effect is ſooner produced in a moiſt than a dry air.

The regulus is obtained by making the calx or ore of manganeſe into a ball with pitch, and putting it into a crucible with powdered charcoal one-tenth of an inch thick on the ſides and a quarter of an inch at the bottom. The empty ſpace is then to be filled with powdered charcoal, covering the crucible with another. Having luted the joints, the whole is to be expoſed to the ſtrongeſt heat of a forge for an hour or more. This regulus is ſoluble in all the acids, but moſt readily in the nitrous, the ſolution in which is generally, a browniſh colour. though that in the others is moſtly colourleſs. The brown colour in the nitrous ſolution ariſes from the mixture of a ſmall portion of iron, and there is always a black reſiduum reſembling plumbago left undiſſolved. Aerated alkalies throw down a white precipitate from theſe ſolutions, which by heat grows black and is converted into the original calx of the metal

Regulus of manganeſe melts readily with other metals, mercury alone excepted. Copper, united with a certain quantity of it, is extremely malleable ; but ſcarce any traces of the red colour are to be ſeen on the ſurface when poliſhed, but the mixture ſometimes has a green effloreſcence by age. Its decompoſition by air is very remarkable. A piece of it newly made, when put into a dry bottle well corked, remained perfect for ſix months : but afterwards, when expoſed only for two days to the open air of a chamber, contracted a brown colour on the ſurface, and became ſo friable as to crumble, into powder between the fingers the internal parts only retaining an obſcure metallic ſplendour, which alſo diſappeared in a few hours.

This ſurpriſing facility of decompoſition might naturally lead us to ſuppoſe that no ſuch thing as native manganeſe could exiſt in the earth. In the *Journal de Phyſique* for January 1786, however, M. de Peyrouſe gives an account of a native regulus of manganeſe, the properties of which are as follow : 1. In appearance it very much reſembles the artificial regulus already mentioned. 2. It dirties the fingers by handling. 3. None of its particles are in the leaſt affected by the magnet. 4. It is compoſed of laminæ having a kind of divergence among themſelves. 5. Its metallic brilliancy is the ſame with that of the artificial regulus, and it has a partial malleability. 6. When repeatedly hammered, it exhibits a kind of exfoliation, forming itſelf into very thin leaves. 7. Its opacity and denſity are ſo completely ſimilar to the artificial regulus, that were it not for the matrix in which the latter is imbedded, it would be in a manner impoſſible to diſtinguiſh them.

This regulus is not found in large maſſes, or in any ſolid continuous body, but only in clots or lumps incloſed and intermixed with the powdery or calciform ore. Theſe lumps are ſomewhat flattened or compreſſed in their form like the artificial ones, though for the moſt part they are of a larger ſize. This powdery magneſian ore, in which the reguline lumps are imbedded, has an argentine hue, as if the materials had been ſubjected to ſome violent heat upon the ſpot.—This regulus was found among the iron mines of *Sem* in the valley of *Viedorſos*, in the county of Foix, near the Pyrenean mountains.

Manganeſe is found in a calciform ſtate, of various colours. M. de Magellan obſerves, that the aerial acid is the only mineralizer of this ſemimetal in its dry ſtate ; and that in proportion to the different degrees of phlogiſtication, a variety of colours is produced. When it contains as much phlogiſton as poſſible, without being reduced to a regulus, it always appears of a white colour, and contains about 43 *per cent.* of fixed air. In proportion to its dephlogiſtication and union with other ſubſtances, its colour is either blue, green, yellow, red, or black.

The black manganeſe ſeems to be the decayed particles of that which is indurated. The latter is met with either pure, or in form of balls, ſeemingly compoſed of concentric fibres ; ſometimes, but very rarely, it is met with of a white colour. Cronſtedt informs us, that he had a ſpecimen of this from an unknown place in Norway. He found that it differed from the common kind by giving a deep red colour to borax in the fire. By calcination it aſſumes a reddiſh brown colour.

Blue mangancſe, according to Mr Scheele, acquires its colour from the phlogiſton which it is enabled to retain by its union with fixed alkalies. Green ariſes from a mixture of the blue with the yellow calx of iron, and the yellow colour, from a prevalence of this calx; red from a ſlight dephlogiſtication of the calx; and black from a thorough dephlogiſtication of it.—The white kind, abovementioned, contains but a very ſmall proportion of iron. Rinman found it both in ſmall white cryſtals and in round maſſes in the cavities of quartz, and adhering to glanz-blende. The hardneſs rather leſs than limeſtone, the texture ſparry, and the ſubſtance ſcarcely magnetic even after roaſting: it affords a colourleſs ſolution with nitrous acid, from which mild alkalies throw down a white precipitate turning black with heat, as already mentioned, of the regulus itſelf. The white ore has alſo been found vegetating on the ſurface of ſome iron ores, particularly hæmatites. Mr Rinman alſo met with it in the form of calcareous ſpar of the colour of roſin, ſomewhat ſhining, and covered over in ſome places with a ſooty powder. It is found alſo in thin pieces, tranſparent at the edges, but not hard enough to ſtrike fire. This conſiſts of manganeſe bedded in zeolite. It melts *per ſe* with the heat of a blow-pipe into a whitiſh grey porous ſlag; and with the addition of calcined borax gives a garnet colour to glaſs. According to Kirwan, many of the white ſparry iron ores may be claſſed among thoſe of manganeſe, as they contain more of the ſemimetal than of iron.

Red manganeſe is ſaid to be found in Piedmont, but Cronſtedt ſays he never ſaw it. He was told by an ingenious workman, that this variety is free from iron, and gives rather a red than violet colour to glaſs. Mr Kirwan ſays, that this kind has leſs fixed air and more iron than the white kind. It is alſo joined with ponderous earth, calcareous earth, ponderous ſpar, and flint. It is found either looſe or ſemi-indurated, in a matrix of calcareous ſpar, on talcky ſchiſtus, or on hæmatites or other iron ores. It is found likewiſe in heavy hard maſſes of lamellar, radiated, or equable texture, or cryſtallized in pyramids, rhomboids, or ſhort brittle needles.

Manganeſe is alſo met with in a ſtate of union with iron. This is black, with a metallic ſplendour, and is the kind commonly employed in glaſs-houſes and potteries. There are ſeveral varieties of this ſtone in the mountains round Bath named Mendip-hills, of which the Briſtol potters conſume great quantities. The black ores of manganeſe differ but little from the brown ones. They are both found either cryſtallized as the red ores, or in ſolid maſſes, ſome of which have a metallic appearance; but others are dull, earthy, and mixed, or embodied in quartz, or in a loſe earthy form. Their ſpecific gravity is about 4.000. The black manganeſe is met with either ſolid and of a ſlaggy texture, ſteel-grained, radiated, or cryſtallized.

The perigord ſtone belongs to this ſpecies of manganeſe. It is of a dark grey colour like the baſaltes, and may be ſcraped with a knife, but cannot be broken with out difficulty. It is very compact, heavy, and as black internally, as charcoal. It has a glittering appearance of a ſtriated kind, like the ore of antimony; and its particles are diſpoſed in the form of needles croſſing one another without any agglutination, inſomuch that ſome are looſe in a manner ſimilar to iron-filings when ſtuck to a loadſtone, and reſembling on the whole the ſcoria from a blackſmith's forge. By calcination this ſubſtance aſſumes a reddiſh brown colour, and becomes harder, but is not magnetic. It does not melt *per ſe*, but affords an amethyſt-coloured glaſs with borax. Nitrous acid has little effect upon it without ſugar. It ſeems to contain clay and ſome iron, and is of conſiderable ſpecific gravity. It is found in ſome parts of England as well as in Gaſcony and Dauphiny in France. The French potters and common enamellers ſometimes employ this ſubſtance in the glazing of their ware.

Black-wadd is likewiſe an ore of manganeſe. It is found in Derbyſhire, and is of a dark brown colour, partly in powder, and partly indurated and brittle. If half a pound of it be dried before the fire, and afterwards ſuffered to cool for an hour, and two ounces of linſeed oil afterwards added, mixing the whole looſely like barm with flour, little clots will be formed, and, in ſomething more than half an hour the whole will grow hot, and at laſt burſt into flame. The heat of the room in which this experiment was tried might be about 30° of Fahrenheit, and the heat to which it was expoſed in drying about 130. According to Wedgwood's Analyſis, this ore contains 43 parts of manganeſe, as much iron, $4\frac{1}{2}$ of lead, and near 5 of micaceous earth.

Beſides the ores mentioned above, Scheele informs us, that he has found manganeſe exiſting in pot-aſhes. Chemiſts, he tells us, have often obſerved, that alkaline ſalts, when calcined, aſſume a bluiſh or greeniſh colour. The cauſe of this has been ſaid to be a quantity of phlogiſton preſent in the alkali; but to this he objects, that ſuch a colour is not deſtroyed by fuſion with nitre. When fixed alkali is made to run over the crucible by too ſtrong a fire, the part that attaches itſelf to the outſide acquires a dark-green colour in conſequence of the aſhes uniting with it. If one part of alkali of tartar be mixed with one-fourth of fine ſifted aſhes and one-eighth of nitre, a dark-green maſs is obtained, which, by ſolution in water, affords a beautiful green ſolution, and when, filtered turns red on the addition of a few drops of vitriolic acid. Some days afterwards a ſmall quantity of brown powder falls to the bottom, which diſcovers the ſame chemical properties as manganeſe. On diſſolving a quantity of ſifted aſhes in muriatic acid by digeſtion in a ſand-heat, the ſame ſmell of aqua-regia ariſes that is perceived on mixing manganeſe with ſpirit of ſalt. Adding ſome hours afterwards a certain quantity of vitriolic acid, in order to precipitate the greater part of the calcareous earth, the liquor had a yellow colour when filtered, and by means of fixed alkali let fall a yellow precipitate, which by calcination turned of a dark-grey, and ſhowed ſigns of containing manganeſe. Hence it appears that manganeſe really exiſts in the aſhes of vegetables, but not equally in all; for Mr Scheele obſerves, that wood-aſhes contain much more than thoſe of thyme (*thymus ſerpillum*).

Mr Scheele has laboured exceedingly to decompoſe this ſubſtance, and to diſcover its component parts. He candidly acknowledges, however, that he did not ſucceed in this inveſtigation according to his wiſh, and therefore cannot be certain that his concluſions are altogether juſt. The following experiments, however, he tells us, were made with the greateſt accuracy as well as expence of time and trouble.

Half an ounce of phlogiſticated manganeſe, purified from all foreign particles, was calcined upon an iron-plate till it grew black. It was then diſſolved in diluted vitriolic acid, with the addition of a little ſugar, in a ſand-heat till the ſolution became limpid. On cooling, a fine ſhining powder precipitated, which proved to be ſelenite. Having ſeparated this by filtration, and then diluted the ſolution with ſix ounces of diſtilled water, precipitating it afterwards by vegetable alkali, the powder was edulcorated, and again expoſed to calcination (A). The manganeſe, when deprived of its phlogiſton was again diſſolved by means of ſugar in diluted vitriolic acid; by which means as much ſelenite was obtained as before. The filtered ſolution was treated exactly in the ſame manner, and the operation repeated eleven times, yielding to appearance as much ſelenite as before. On weighing the reſults of all theſe calcinations, the manganeſe was found to be reduced to three drachms and five grains, and the quantity of ſelenite had increaſed to 49 grains; the whole ſeems therefore to be convertible into calcareous earth. On attempting to invert the experiment, and to produce manganeſe by combining phlogiſton with calcareous earth, he found it impoſſible to unite the two ſubſtances by any means he could deviſe.

This analyſis of manganeſe was undertaken at the deſire of Mr Bergman; who having informed him that Mr Sage ſuppoſes manganeſe to be nothing elſe than a mineraliſed mixture of cobalt and zinc, he afterwards made ſeveral experiments with a view to detect theſe ſubſtances, but in vain. "Manganeſe (ſays Mr Bergman) has been claſſed by all mineralogiſts among the ores of iron; but Mr Pott ſuppoſed the iron to be only accidently mixed with it; and at laſt Mr Cronſtedt, in his Eſſay on Mineralogy, 1758, placed it among the earths. For my part, however, I muſt own that there are ſeveral circumſtances which make me think that it is a metallic ſubſtance. No pure earth colours glaſs, but all metallic calces have this property. Manganeſe, therefore, in this reſpect, ſhows a great reſemblance to the latter; which is further increaſed by its ſpecific gravity, and its ſtrong attraction for phlogiſton." Having then mentioned its precipitation by the Pruſſian alkali as an additional proof of its metallic nature, he proceeds thus: "But what kind of metal it is which manganeſe contains is not ſo eaſily aſcertained. The ſolution of cobalt does not loſe its colour on adding ſugar or any other phlogiſtic ſubſtance, and zinc does not impart any colour to acids. Theſe two ſubſtances conſequently differ from manganeſe, which does not indeed entirely agree with any other of the known metallic earths. I have, however, great reaſon to conjecture that it muſt be platina, the earth of which is not yet known; or a new metal, which at leaſt would agree with platina in the great difficulty with which it fuſes."

It has already been obſerved, that manganeſe is uſed in glaſs-works, and is capable both of deſtroying the colour of glaſs, and of giving a new colour to it, viz. that of violet. Mr Scheele deduces its operation from the properties related under the article Chemistry, n° 1359 & ſeq. He enumerates its effects on glaſs-fluxes as follows: 1. A colourleſs glaſs-flux becomes conſtantly more or leſs red on an addition of manganeſe, according to the quantity. 2. If the flux be a little alkaline, the colour will approach to violet. 3. Arſenic, gypſum, and calx of tin, deſtroy the red colour in theſe glaſſes, and thus render them clear. The action of arſenic is eaſily explained from Chemistry, n° 919, where it is ſhown that manganeſe, decompoſes arſenic by uniting with its phlogiſton, and that arſenic itſelf is compoſed of an acid of a peculiar nature united with phlogiſton. On mixing manganeſe, therefore, with glaſs in fuſion, the phlogiſton of the arſenic unites with the mangeneſe, while the acid of arſenic unites with the alkali of the glaſs. This experiment ſucceeds in a covered crucible, though never when gypſum or calx of tin are made uſe of; but on adding powdered charcoal, an efferveſcence enſues, the red colour diſappears, and the glaſs becomes colourleſs. The phlogiſton of the charcoal is therefore the cauſe of the deſtruction of the colour, and the efferveſcence is a neceſſary conſequence of the emiſſion of the phlogiſton 4. If glaſs coloured red by manganeſe be fuſed in a crucible with powdered charcoal, the colour diſappears during the efferveſcence without the addition of gypſum or calx of tin; but on keeping the glaſs a long time in fuſion upon charcoal, by means of the blow-pipe, the colour does not diſappear. Nay, if the colourleſs glaſs be kept in this ſtate for a ſhort time upon charcoal, it grows red again. 5. By adding a little ſulphur, the colour diſappears; and the ſame thing takes place on the addition of any metallic calx or any neutral ſalt containing the vitriolic acid. But here it muſt be obſerved, that all metals whoſe calces colour glaſs, while they deprive it of that which it has received from the manganeſe, will not fail to communicate their own peculiar colour to it. If to ſuch a colourleſs glaſs globule, nitre, even in the ſmalleſt quantity, be added, it preſently grows red again; and the ſame thing happens if ſuch a colourleſs glaſs globule be kept in fuſion for a few minutes upon an iron plate; and thus the red colour may be made to appear and diſappear as often as we pleaſe.

From this explanation it appears how manganeſe purifies glaſs. When the colour of it depends on a quantity of coaly matter, it is improper to add more than is juſt ſufficient to ſaturate the phlogiſton. With regard to the green colour of common bottle-glaſs, Mr Scheele made the following experiment to determine whether it proceeded from iron or not. Having melted green glaſs by the blow-pipe upon a piece of the ſame ſubſtance, leſt in uſing a crucible he ſhould have been deceived by the iron it contained, he poured

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(A) As in this proceſs a quantity of fixed air is always expelled from the alkali, it was neceſſary, in order to prevent any of the manganeſe from being diſſolved by it, to place the whole for ſome hours upon hot ſand to expel the aerial fluid.

ed upon it a large quantity of muriatic acid; and having extracted a tincture, and poured into it a few drops of the ſolution of Pruſſian alkali, it aſſumed a bluiſh colour. Hence he concludes, that iron, nearly in its metallic form, is preſent in common green glaſs: for its calx always gives a yellowiſh colour to glaſs, and manganeſe added to a ſolution of iron in acids deſtroys the green colour; ſubſtituting a yellow one in its room; and in like manner, nitre added to green glaſs in fuſion takes away its colour. The ſame effect is produced by manganeſe if added in proper quantity; though, according to the experiments of Mr Scheele, ſomewhat of a yellowiſh colour ought to have been communicated by it; and he is of opinion that it was really ſo, though the quantity of iron was too ſmall to render it diſtinctly viſible. It is alſo remarkable, that the rays of light paſſing through glaſs of this kind, when nearly red hot, appear of a yellowiſh colour.

Mr Engeſtrom's experiments on this ſubject are ſomewhat different from thoſe of Mr Scheele. Having melted manganeſe and borax together upon a piece of charcoal, the glaſs at firſt aſſumed the common colour of manganeſe; but this was repeatedly deſtroyed, and made to appear without adding any thing. During the operation he took notice of the following phenomena; 1. When a ſmall quantity of manganeſe was taken, the colour was light, but with a larger it became nearly black; and whatever colour it aſſumed on the firſt fuſion was manifeſted alſo at the ſecond, when it was made to reappear. 2. Manganeſe, on being melted with borax, efferveſces violently; which ceaſes, however, as ſoon as the manganeſe is diſſolved. 3. To make the colour of the glaſs diſappear, it was neceſſary only to direct the blue flame of the candle upon the glaſs, and that equally and conſtantly, but not very violently. On blowing more faintly, and allowing the brown flame to touch the place, the colour returned. 4. About the time that the glaſs becomes colourleſs, a kind of ſection or partition is obſerved in it; and as ſoon as the colour diſappears, the blowing muſt be immediately diſcontinued, ſo that the brown flame ſhall not afterwards touch the glaſs. When it is taken out with the forceps, it appears perfectly colourleſs. 5. This deſtruction of the colour ſeems not to happen ſuddenly, but by degrees; for when the blowing was now and then diſcontinued before the true mark had appeared, the glaſs was generally lighter than before, though not quite colourleſs.

Though our author had been able to diſcharge the colour thus from glaſs, and to make is reappear, it ſeemed doubtful whether this could be done frequently; for having blown the blue flame violently againſt ſome glaſs, the colour of which he had already twice diſcharged and made to reappear, he found that it could not again be diſcharged even by conſtant blowing for an hour. In an other experiment, having added a large quantity of manganeſe, he found that the glaſs retained its colour even in the utmoſt heat he could give it, though it always became colourleſs when warm, but regained its colour in the cold.

In both theſe experiments, the violence of the flame had diſperſed and driven off ſome ſmall globules which always remained colourleſs; the reaſon of this he thinks is, that manganeſe, or its colouring part, has a ſtrong attraction for a ſmall part only of borax; and that, by means of a violent heat, the ſuperfluous part may be ſeparated, and the reſt unite more cloſely with the earthy particles. The ſame thing happened likewiſe with the ſmall globules which ſometimes remained after the maſs was taken away, fixed to the charcoal by the violence of the flame. "If this is really the caſe (ſays he), it would follow, that by repeating the experiment ſome of theſe particles would always ſeparate if a ſufficiently ſtrong flame was applied, and it would be impoſſible to expel the red colour afterwards. I dare not, however, advance this conjecture, though it is grounded on ſome experiments, as a matter of certainty."

Cronſtedt obſerves, that manganeſe communicates a colour both to glaſſes and ſaline ſolutions. Borax, which has diſſolved it, becomes tranſparent, and aſſumes a reddiſh brown hyacinthine colour; the microcoſmic ſalt becomes tranſparent, of a crimſon colour, and moulders in the air. In compoſitions for glaſs it becomes violet with the fixed alkali; but if a great quantity of manganeſe be added, the glaſs is in thick lumps and looks black; by ſcorification with lead the glaſs obtains a reddiſh brown colour. Manganeſe deflagrates with nitre; and the reſiduum, when thus deflagrated, communicates a deep-red colour to its lixivium. The calx, when reckoned to be light, weighs as much as an iron ore of the ſame texture. It ferments with vitreous compoſitions, and ſtill more when melted with the microcoſmic ſalt. The colours communicated by manganeſe to glaſſes are eaſily deſtroyed by the calx of tin or arſenic, and likewiſe vaniſh of themſelves in the air.

According to Dr Brunnich, manganeſe, when melted with nitre, aſſumes a green colour. Tin unites very readily with manganeſe; but zinc not without great difficulty, perhaps on account of its volatility and inflammable nature. White arſenic adheres to it, and, by means of the phlogiſton, reduces it to a metallic form. By ſimple calcination a blackiſh powder is produced; but if the ignition be continued for twelve days, it acquires a dark green colour; producing alſo, ſometimes, one of a white or reddiſh colour. All theſe various calces, by means of a ſufficient degree of heat in a common crucible, run into a yellowiſh-red glaſs, which is pellucid, unleſs from too great thickneſs.

MANGE, in dogs. See *Diſeaſes of Dogs*.

MANGE, in farriery, See there, § xxiii.

MANGEART (Dom. Thomas), a Benedictine of the congregation of St Vanne and St Hidulphe, whoſe knowledge was an ornament to his order. It gained him alſo the titles of antiquarian, librarian, and counſellor, to Charles Duke of Lorrian. He was preparing a very conſiderable work when he died. A. D 1763, before he had put his laſt hand to his book, which was publiſhed by Abbe Jacquin. This production appeared in 1760 in folio, with this title: *Introduction à la ſcience des Medailles, pour ſervir a la connoiſſance des Dieux, de la Religion, des Sciences, des Arts, et de tout ce qui appartient a l'Hiſtoire ancienne, avec les preuves tirées des Medailles.* The elementary treatiſes on the numiſmatic ſcience were not ſufficiently extenſive, and the particular diſſertations were by far too tedious and prolix. This learned Benedictine has collected into a ſingle volume all the principles contained in the former, and all the ideas of any conſequence which are to be found ſcattered through the latter. His work may ſerve as a ſupplement to Montfaucon's *Antiquity explained.* From Mangeart we likewiſe have a volume of ſermons; and a treatiſe on Purgatory, Nancy, 1739, 2 vols 12mo.

MANGEL-WURZEL. See BETA; and AGRICULTURE, n° 52.

MANGER, is a raiſed trough under the rack in the ſtall, made for receiving the grain or corn that a horſe eats.

MANGER, a ſmall apartment, extending athwart the lower-deck of a ſhip of war, immediately within the hauſe-holes, and fenced on the after-part by a partition, which ſeparates it from the other part of the deck behind it. This partition ſerves as a fence to interrupt the paſſage of the water, which occaſionally guſhes in at the hauſe holes, or falls from the wet cable whilſt it is heaved in by the capſtern. The water, thus prevented from running aft, is immediately returned into the ſea by ſeveral ſmall channels, called *ſcuppers,* cut through the ſhip's ſide within the manger. The manger is therefore particularly uſeful in giving a contrary direction to the water that enters at the hauſe-holes, which would otherwiſe run aft in great ſtreams upon the lower-deck, and render it extremely wet and uncomfortable, particularly in tempeſtuous weather, to the men who meſs and ſleep in different parts thereof.

MANGENOT (Lewis), a cannon of the temple at Paris, where he was born A. D. 1694, and died in 1768 at the age of 74. He was a ſocial poet, and an amiable man. But although lively and agreeable in his converſation, his character leaned ſomewhat towards cynical miſanthropy, Of this we may judge from the following verſes, written on a little parlour which he had erected in a garden dependent on his benefice:

Sans inquietude, ſans peine,
Je jouis dans ces lieux du deſtin le plus beau.
Les Dieux m'ont accorde l'Ame de Diogene;
Ei mes foibles talens m' ont valu ſou tonneau.

His Poems were publiſhed at Amſterdam in 1776. This collection contains two eclogues full of nature, ſimplicity, and elegance; fables ſome of which are well compoſed; tales, which are by far too licentious; moral reflections; ſentences; madrigals, &c. &c.

MANGET (John-James), an eminent phyſician, born at Geneva in 1652. The elector of Brandenburg made him his firſt phyſician in 1699; in which poſt he continued till his death, which happened at Geneva in 1742. He wrote many works; the moſt known of which are, 1. A collection of ſeveral Pharmacopœias, in folio. 2. *Bibliotheca pharmaceutico-medica.* 3. *Bibliotheca anatomica.* 4. *Bibliotheca chemica.* 5. *Bibliotheca chirurgica.* 6. A *bibliotheca* of all the authors who have written on medicine, in 4 vols folio. All theſe works are in Latin. Daniel le Clerc, the author of a Hiſtory of Phyſic, aſſiſted him in writing them.

MANGIFERA, the MANGO-TREE, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking with thoſe of which the order is doubtful. The corolla is pentapetalous; the plum kidney-ſhaped. There is but one ſpecies, a native of many parts of the Eaſt Indies, whence it has been tranſplanted to Brazil and other warm parts of America. It grows to a large ſize; the wood is brittle, the bark rough when old; the leaves are ſeven or eight inches long, and more than two inches broad. The flowers are produced in looſe panicles at the ends of the branches, and are ſucceeded by large oblong kidney-ſhaped plums. This fruit, when fully ripe, is greatly eſteemed in the countries where it grows; but in Europe we have only the unripe fruit brought over in pickle. All attempts to propagate the plant have hitherto proved ineffectual; and Mr Miller is of opinion that the ſtones will not vegetate unleſs they are planted ſoon after they are ripe. He thinks therefore that the young plants ought to be brought over in boxes of earth; after which they may be kept in the tanbed of the ſtove.

MANGOSTAN, or MANGOSTEEN. See GARCINIA.

MANGROVE. See RHIZOPHORA.

MANHEIM, a town of Germany, in the Lower Palatinate, with a very ſtrong citadel, and a palace, where the elector Palatine often reſides. It is ſeated at the confluence of the rivers Neckar and Rhine, in E. Long. 8. 33. N. Lat. 49. 25.

MANHOOD, that ſtage of life which ſucceeds puberty or adoleſcence. See MAN, n° 23.

MANIA, or MADNESS. See MEDICINE-*Index.*

MANICHEES, or MANICHEANS (*Manichæi*), a ſect of ancient heretics, who aſſerted two principles; ſo called from their author *Manes* or *Manichæus,* a Perſian by nation, and educated among the magi, being himſelf one of that number before he embraced Chriſtianity.

This hereſy had its firſt riſe about the year 277, and ſpread itſelf principally in Arabia, Egypt, and Africa. St Epiphanius, who treats of it at large, obſerves, that the true name of this hereſiarch was Cubricus; and that he changed it for *Manes,* which in the Perſian or Babyloniſh language ſignifies *veſſel.* A rich widow, whoſe ſervant he had been, dying without iſſue, left him ſtore of wealth; after which he aſſumed the title of the *apoſtle* or *envoy of Jeſus Chriſt.*

Manes was not contented with the quality of apoſtle of Jeſus Chriſt, but he alſo aſſumed that of the Paraclete, whom Chriſt had promiſed to ſend: which Auguſtin explains, by ſaying, that Manes endeavoured to perſuade men, that the Holy Ghoſt did perſonally dwell in him with full authority. He left ſeveral diſciples, and among others Addas, Thomas, and Hermas. Theſe he ſent in his lifetime into ſeveral provinces to preach his doctrine. Manes, having undertaken to cure the king of Perſia's ſon, and not ſucceeding, was put in priſon upon the young prince's death, whence he made his eſcape; but he was apprehended ſoon after, and flayed alive.

However, the oriental writers, cited by D'Herbelot and Hyde, tell us, that Manes, after having been protected in a ſingular manner by Hormizdas, who ſucceeded Sapor in the Perſian throne, but who was not able to defend him, at length, againſt the united hatred of the Chriſtians, the Magi, the Jews, and the Pagans, was ſhut up in a ſtrong caſtle, to ſerve him as a refuge againſt thoſe who perſecuted him on account of his doctrine. They add, that after the death of Hormizdas, Varanes I. his ſucceſſor, firſt protected Manes, but afterwards gave him up to the fury of the Magi, whoſe reſentment againſt him was due to his having adopted the Sadducean principles, as ſome ſay; while others attribute it to his having mingled the tenets of the Magi with the doctrines of Chriſtianity. However, it is certain that the Manicheans celebrated the day of their maſters death. It has been a ſubject of much controverſy whether Manes were an impoſtor. The learned Dr Lardner has examined the arguments on both ſides; and though he does not chooſe to deny that he was an impoſtor, he does not diſcern evident proofs of it. He acknowledges, that he was an arrogant philoſopher and a great ſchemiſt; but whether he was an impoſtor, he cannot certainly ſay. He was much too fond of philoſophical notions, which he endeavoured to bring into religion, for which he is to be blamed: nevertheleſs, he obſerves, that every bold dogmatiſer is not an impoſtor.

The doctrine of Manes was a motley mixture of the tenets of Chriſtianity with the ancient philoſophy of the Perſians, in which he had been inſtructed during his youth. He combined theſe two ſyſtems, and applied and accommodated to Jeſus Chriſt the characters and actions which the Perſians attributed to the god Mithras.

He eſtabliſhed two principles, *viz.* a good and an evil one: the firſt, a moſt pure and ſubtile matter, which he calls *light*, did nothing but good; and the ſecond a groſs and corrupt ſubſtance, which he called *darkneſs*, nothing but evil. This philoſophy is very ancient; and Plutarch treats of it at large in his Iſis and Oſiris.

Our ſouls, according to Manes, were made by the good principle, and our bodies by the evil one; thoſe two principles being according to him, coeternal and independent of each other. Each of theſe is ſubject to the dominion of a ſuperintendent being, whoſe exiſtence is from all eternity. The being who preſides over the *light* is called *God;* he that rules the land of *darkneſs* bears the title of *hyle* or *demon*. The ruler of the *light* is ſupremely happy, and in conſequence thereof benevolent and good: the prince of *darkneſs* is unhappy in himſelf, and deſirous of rendering others partakers of his miſery, and is evil and malignant. Theſe two beings have produced an immenſe multitude of creatures, reſembling themſelves, and diſtributed them through their reſpective provinces. After a conteſt between the ruler of *light* and the prince of *darkneſs*, in which the latter was defeated, this prince of *darkneſs* produced the firſt parents of the human race. The beings engendered from this original ſtock, conſiſt of a body formed out of the corrupt matter of the kingdom of darkneſs, and of two ſouls; one of which is ſenſitive and luſtful, and owes its exiſtence to the evil principle; the other rational and immortal, a particle of that divine light which had been carried away in the conteſt by the army of darkneſs, and immerſed into the maſs of malignant matter. The earth was created by God out of this corrupt maſs of matter, in order to be a dwelling for the human race, that their captive ſouls might by degrees be delivered from their corporeal priſons, and the celeſtial elements extended from the groſs ſubſtance in which they were involved. With this view God produced two beings from his own ſubſtance, *viz.* Chriſt and the Holy Ghoſt: for the Manicheans held a conſubſtantial Trinity. Chriſt, or the glorious intelligence, called by the Perſians *Mithras*, ſubſiſting in and by himſelf, and reſiding in the ſun, appeared in due time among the Jews, clothed with the ſhadowy form of a human body, to diſengage the rational ſoul from the corrupt body, and to conquer the violence of malignant matter. The Jews, incited by the prince of darkneſs, put him to an ignominious death, which he ſuffered not in reality, but only in appearance, and according to the opinion of men. When the purpoſes of Chriſt were accompliſhed, he returned to his throne in the ſun, appointing apoſtles to propagate his religion, and leaving his followers the promiſe of the Paraclete or Comforter, who is Manes the Perſian. Thoſe ſouls who believe Jeſus Chriſt to be the ſon of God, renounce the worſhip of the god of the Jews, who is the prince of darkneſs, and obey the laws delivered by Chriſt, and illuſtrated by Manes the Comforter, are gradually purified from the contagion of matter; and their purification being completed, after having paſſed through two ſtates of trial, by water and fire, firſt in the moon and then in the ſun, their bodies return to the original maſs (for the Manicheans derided the reſurrection of bodies), and their ſouls aſcend to the regions of light. But the ſouls of thoſe who have neglected the ſalutary work of purification, paſs after death into the bodies of other animals or natures, where they remain till they have accompliſhed their probation. Some, however, more perverſe and obſtinate, are conſigned to a ſeverer courſe of trial, being delivered over for a time to the power of malignant aerial ſpirits, who torment them in various ways. After this a fire ſhall break forth and conſume the frame of the world: and the prince and powers of darkneſs ſhall return to their primitive ſeats of anguiſh and miſery, in which they ſhall dwell for ever. Theſe manſions ſhall be ſurrounded by an invincible guard, to prevent their ever renewing a war in the regions of light.

Manes borrowed many things from the ancient Gnoſtics; on which account many authors conſider the Manicheans as a branch of the Gnoſtics.

In truth, the Manichean doctrine was a ſyſtem of philoſophy rather than of religion. They made uſe of amulets, in imitation of the Baſilidians; and are ſaid to have made profeſſion of aſtronomy and aſtrology. They denied that Jeſus Chriſt, who was only God, aſſumed a true human body, and maintained it was only imaginary: and therefore they denied his incarnation, death, &c. They pretended that the law of Moſes did not come from God, or the good principle, but from the evil one; and that for this reaſon it was abrogated. They rejected almoſt all the ſacred books in which Chriſtians look for the ſublime truths of their holy religion. They affirm, that the Old Teſtament was not the work of God, but of the prince of darkneſs, who was ſubſtituted by the Jews in the place of the true God. They abſtained entirely from eating the fleſh of any animal; following herein the doctrine of the ancient Pythagoreans: they alſo condemned marriage. The reſt of their errors may be ſeen in St Epiphanius and St Auguſtin; which laſt, having been of their ſect, may be preſumed to have been thoroughly acquainted with them.

Tho' the Manichees profeſſed to receive the books of the New Teſtament, yet in effect they only took ſo much of them as ſuited with their own opinions.

They firſt formed to themſelves a certain idea or ſcheme of Chriſtianity; and to this adjuſted the writings of the apoſtles, pretending that whatever was inconſiſtent with this had been foiſted into the New Teſtament by later writers who were half Jews. On the other hand, they made fables and apocryphal books paſs for apoſtolical writings; and even are ſuſpected to have forged ſeveral others, the better to maintain their errors. St Epiphanius gives a catalogue of ſeveral pieces publiſhed by Manes, and adds extracts out of ſome of them. Theſe are the Myſteries, Chapters, Goſpel, and Treaſury,

The rule of life and manners which Manes preſcribed to his followers was moſt extravagantly rigorous and ſevere. However, he divided his diſciples into two claſſes; one of which comprehended the perfect Chriſtians, under the name of the *elect*; and the other the imperfect and feeble, under the title of *auditors* or *hearers*. The elect were obliged to a rigorous and entire abſtinence from fleſh, eggs, milk, fiſh, wine, all intoxicating drink, wedlock, and all amorous gratifications; and to live in a ſtate of the ſevereſt penury, nouriſhing their emaciated bodies with bread, herbs, pulſe, and melons, and depriving themſelves of all the comforts that ariſe from the moderate indulgence of natural paſſions, and alſo from a variety of innocent and agreeable purſuits. The auditors were allowed to poſſeſs houſes, lands, and wealth, to feed on fleſh, to enter into the bonds of conjugal tenderneſs; but this liberty was granted them with many limitations, and under the ſtricteſt conditions of moderation and temperance. The general aſſembly of the Manicheans was headed by a preſident, who repreſented Jeſus Chriſt. There were joined to him 12 rulers or maſters, who were deſigned to repreſent the 12 apoſtles, and theſe were followed by 72 biſhops, the images of the 72 diſciples of our Lord. Theſe biſhops and preſbyters or deacons under them, and all the members of theſe religious orders were choſen out of the claſs of the elect. Their worſhip was ſimple and plain; and conſiſted of prayers, reading the ſcriptures, and hearing public diſcourſes, at which both the auditors and elect were allowed to be preſent. They alſo obſerved the Chriſtian appointment of baptiſm and the euchariſt. They kept the Lord's day, obſerving it as a faſt; and they likewiſe kept Eaſter and Pentecoſt.

Towards the 4th century the Manicheans concealed themſelves under various names, which they ſucceſſively adopted, and changed in proportion as they were diſcovered by them. Thus they aſſumed the names of Encratites, Apotactics, Saccophori, Hydroparaſtates, Solitaries, and ſeveral others, under which they lay concealed for a certain time, but could not however long eſcape the vigilance of their enemies. About the cloſe of the 6th century, this ſect gained a very conſiderable influence, particularly among the Perſians.

Toward the middle of the 12th century, the ſect of Manichees took a new face, on occaſion of one Conſtantine, an Armenian, and an adherer to it; who took upon him to ſuppreſs the reading of all other books beſides the Evangliſts and the Epiſtles of St Paul, which he explained in ſuch a manner as to make them contain a new ſyſtem of Manicheiſm. He entirely diſcarded all the writings of his predeceſſors; rejecting the chimeras of the Valentinians, and their 30 æons; the fable of Manes, with regard to the origin of rain and other dreams; but ſtill retained the impurities of Baſilides. In this manner he reformed Manicheiſm, inſomuch that his followers made no ſcruple of anathematizing Scythian, Buddas, called alſo *Addas* and *Terebinth*, the contemporaries and diſciples, as ſome ſay, and, according to others, the predeceſſors and maſters of Manes, and even Manes himſelf, Conſtantine being now their great apoſtle. After he had ſeduced an infinite number of people, he was at laſt ſtoned by order of the emperor.

This ſect prevailed in Boſnia and the adjacent provinces about the cloſe of the 15th century; propagated their doctrines with confidence, and held their religious aſſemblies with impunity.

MANICORDON, or MANICHORD, a muſical inſtrument in form of a ſpinnet; the ſtrings of which like thoſe of the clarichord, are covered with little pieces of cloth, to deaden as well as to ſoften their ſound, whence it is alſo called the *dumb ſpinet*.

MANIFESTO; a public declaration made by a prince in writing, ſhowing his intentions to begin a war or other enterpriſe, with the motives that induce him to it, and the reaſons on which he founds his right, and pretenſions.

MANIHOT, or MANIOC. See JATROPHA.

MANILA, LUCONIA, or *Luzon*, the name of the largeſt of the Philippine iſlands in the Eaſt Indies, ſubject to Spain. It had the name of *Luzon* from a cuſtom that prevailed among the natives of beating or bruiſing their rice in wooden mortars, before they either boiled or baked it; luzon, in their language, ſignifying "a mortar."

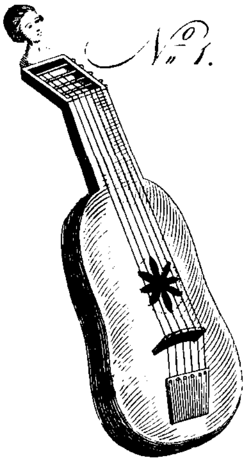
As to ſituation. it is remarkably happy, lying between the eaſtern and weſtern continents, and having China on the north, at the diſtance of about 60 leagues; the iſlands of Japan on the north-eaſt, at the diſtance of about 250 leagues from the neareſt of them; the ocean on the eaſt; the other iſlands on the ſouth; and on the weſt Malacca, Patana, Siam, Cambodia, Cochin-China, and other provinces of India, the neareſt at the diſtance of 300 leagues.

The middle of this iſland is in the latitude 15° north; the eaſt point in 13° 38′, and the moſt northern point in 19°. The ſhape of it is ſaid to reſemble that of an arm bent; the whole length being about 160 Spaniſh leagues, the greateſt breadth between 30 and 40, and the circumference about 350. As to the longitude, the charts differ, ſome making the middle of the iſland to lie 113° eaſt from London, and others in 160°. The climate is hot and moiſt. One thing is held very extraordinary, that in ſtormy weather there is much lightning and rain, and that thunder is ſeldom heard till this is over. During the months of June, July, Auguſt, and part of September, the weſt and ſouth winds blow, which they call *vendavales*, bringing ſuch rains and ſtorms, that the fields are all overflowed, and they are forced to have little boats to go from one place to another. From October till the middle of December, the north wind prevails; and from that time till May, the eaſt and ſouth-eaſt; which winds are there called *breezes*. Thus there are two ſeaſons in thoſe ſeas, by the Portugueſe called *monzeens*; whence our word *monſoons*, that is, the breezes

Plate CCLXXIX.

Machul.

No. 1.



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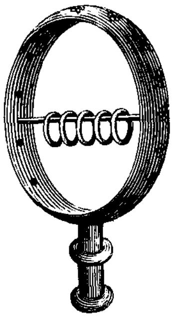
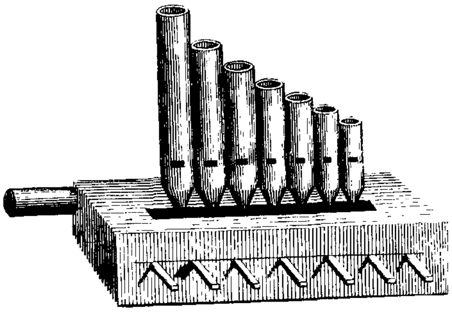
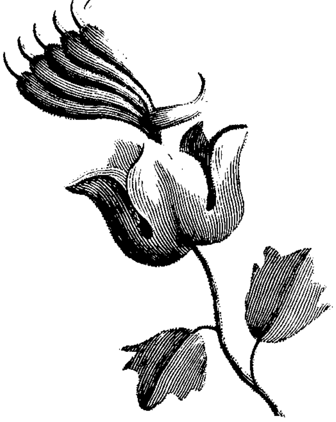


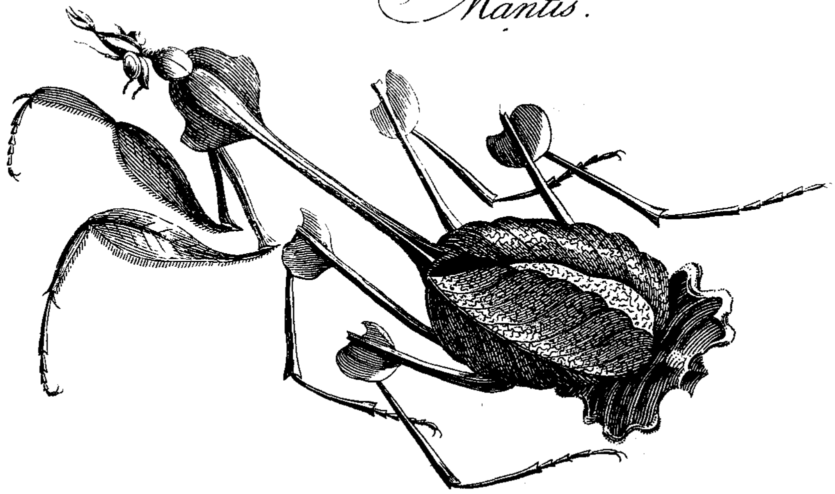
Masrakitha.



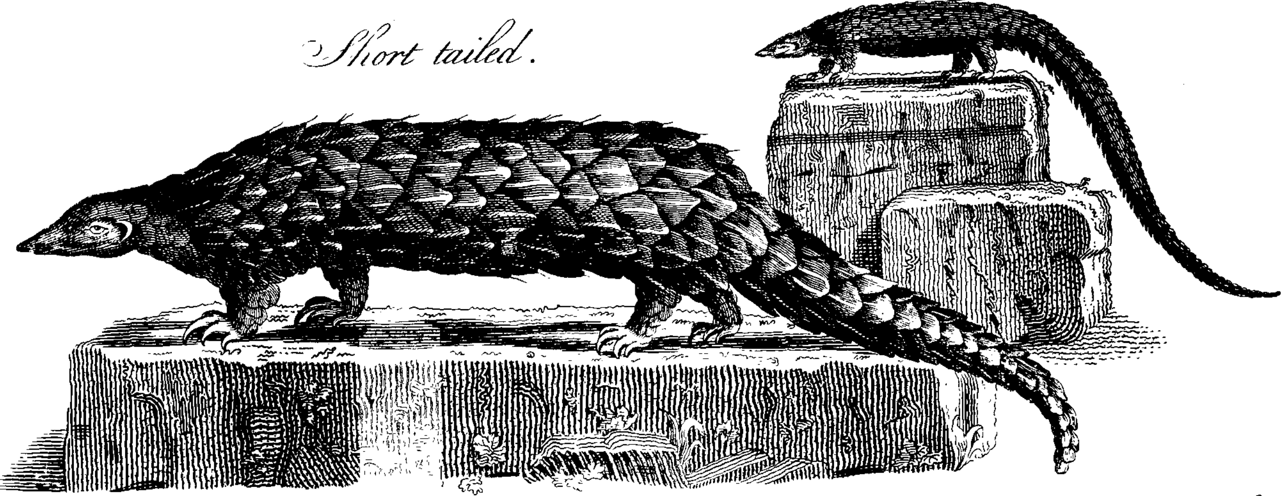
Macpalxochitl.



Mantis.



Manis or Scaly Lizard.



Thackara & Vallance sc.

half the year with a ſerene dry air; and the vendavales the other half, wet and ſtormy. It is further to be obſerved, that in this climate no vermin breed upon Europeans, though they wear dirty ſhirts, whereas it is otherwiſe with the Indians. The days here being always of an equal length, and the weather never cold, neither their clothes, nor the hour of dining, ſupping, doing buſineſs, ſtudying, or praying, are ever changed; nor is cloth worn, but only againſt the rain.

The air here being, as has been obſerved, very hot and moiſt, is not wholeſome; but is worſe for young men that come from Europe than for the old. As for the natives, without uſing many precautions, they live very commonly to fourſcore or 100. The ſoil is ſo rich that rice grows even on the tops of the mountains without being watered; and this makes it ſo plentiful, that the Indians value gold ſo little as not to pick it up, though it lies almoſt every where under their feet.

Among the diſadvantages of the iſland, beſides frequent and terrible earthquakes, here are ſeveral burning mountains. The face of the iſland, however, is far from being disfigured by them, or by the conſequences of their exploſions.

The mountaineers, called *Tingiani*, have no particular place of abode, but always live under the ſhelter of trees, which ſerve them inſtead of houſes, and furniſh them with food; and when the fruit is eaten up, they remove where there is a freſh ſort.

Here are 40 different ſorts of palm-trees, the moſt excellent cocoas, wild cinnamon, wild nutmegs, and ſome ſay wild cloves alſo; ebony; ſandal-wood; the beſt caſſia, and in ſuch plenty, that they feed their hogs with its fruit; all kinds of cattle, and prodigious quantities of gold, amber, and ambergriſe,

There are ſeveral ſorts of people in this iſland beſides the Spaniards, as the Tagalians or Tagaleze, the Pintadoes or painted negroes, the Ilayas or Tinglianos, and the Negrellos. The Tagalians, who are thought to be Malayans by deſcent, are a modeſt, tractable, and well diſpoſed people. The Pintadoes, or painted negroes, are tall, ſtraight, ſtrong, active, and of an excellent diſpoſition. The Tinglianos, whom ſome ſuppoſe to be deſcended from the Japaneſe, are very brave, yet very courteous and humane. They live entirely on the gifts of nature; and never ſleep under any other ſhade than that of the trees or a cave. The Negrellos, who are held to be the Aborigines of the iſland, are barbarous and brutal to the laſt degree. When they kill a Spaniard, they make a cup of his ſkull and drink out of it.

This iſland is divided into ſeveral provinces, containing divers towns, the chief of which are Manila, Caceres, New-Segovia, Bondo, Haſſacao, Ibalon, Bulaw, Serſocon, of Bagatao, Lampon, Fernandina, Bolinao, Playahonda, Cavite, Myndora, Caleleya, and Balayan.

MANILA, the capital of an iſland of the ſame name in the Eaſt Indies, on the ſouth-eaſt ſide of the iſland, where a large river falls into the ſea, and forms a noble bay 30 leagues in compaſs, to which the the Spaniards have given the name of *Bahia*, becauſe the river runs out of the great lake Bahi, which lies at the diſtance of ſix leagues behind it. In compaſs it is two miles, in length one third of a mile; the ſhape irregular, being narrow at both ends, and wide in the middle. On the ſouth it is waſhed by the ſea, and on the north and eaſt by the river; being alſo ſtrongly fortified with walls, baſtions, forts, and batteries.—Manila contains about 30,000 ſouls, who are a very motely race, diſtinguiſhed by ſeveral ſtrange names, and produced by the conjunction of Spaniards, Chineſe, Malabars, Blacks, and others inhabiting the city or iſlands depending on it. Without the walls are large ſuburbs particularly that inhabited by the Chineſe merchants, called *Sangleys*. In proportion to the ſize of the place, the number of churches and religious houſes is very great. Only ſmall veſſels can come up to Manila; but three leagues ſouth of it is the town and port of Cavite, defended by the caſtle of St Philip, and capable of receiving the largeſt ſhips. Here ſtands the arſenal where the galleons are built, for which there are from 300 to 600 or 800 men conſtantly employed, who are relieved every month, and while upon duty are maintained at the king's expence. By an earthquake which happened here in 1645, a third part of the city of Manila was deſtroyed, and no leſs than 3000 people periſhed in the ruins,

In the war before laſt, Spain having entered into engagements with France, in conſequence of the family compact of the houſe of Bourbon, it was found expedient by Britain to declare war alſo againſt Spain. Whereupon a force was ſent out from the Eaſt-India ſettlements, particularly Madras, for the conqueſt of the Philippine Iſlands, under General Draper and Admiral Corniſh: who after a ſiege of 12 days, took Manila on the 6th of October 1762 by ſtorm; but, to ſave ſo fine a city from deſtruction, agreed to accept a ranſom, amounting to a million ſterling; a part of which, it is ſaid, was never paid. The Spaniſh viceroy reſides in the city, and lives like a ſovereign prince. The goverment is ſaid to be one of the beſt in the gift of the king of Spain. When the city was taken, as above, the archbiſhop, who is a kind of pope in this part of the world, was alſo viceroy. Five large ſhips loaded with the riches of the Eaſt, as diamonds from Golconda, cinnamon from Ceylon, pepper from Sumatra and Java, cloves and nutmegs from the Moluccas and Banda iſlands, camphire from Borneo, benjamin and ivory from Cambodia, ſilks, tea, and china-ware from China, &c. ſail yearly from hence to Acapulco in Mexico, and return freighted with ſilver, making 400 per cent. profit.

The city of Manila is governed by two alcaides: the reſt of the cities and great towns have each an alcaide; and in every village there is a corregidore. Appeals from their ſentences are made to the royal court at Manila, in which there are four judges, and a fiſcal or attorney-general; each of theſe judges has a ſalary of 3300 pieces of eight per annum. The viceroy is preſident; and in that quality has an income of 4000 pieces of eight, but he has no vote: yet if the judges are equally divided, the preſident names a doctor of the civil law, who, in virtue of his appointment, has a deciſive voice. The attorney-general, in right of his office, is protector of the Chineſe, in conſideration of which he receives 600 pieces of eight every year. As for the Indians that are in ſubjection, they pay tribute in the following proportions: Young men from

18, and from thence, if they continue ſingle, to the age of 60, pay five rials of plate by way of capitation; as ſingle women likewiſe do from 24 to 50: married men pay ten rials. It is computed, that there are within the compaſs of this government 250,000 Indians, ſubject to his catholic majeſty, of whom two-fifths hold immediately from the king, and the reſt from lords or proprietors, who pay two rials each for the maintenance of the forces, and the like ſum for the pariſh-prieſt. The royal revenue is computed at about half a milion of pieces of eight, excluſive of caſualties. In regard to the military eſtabliſhment, the garriſon of Manila conſiſts of about 800 or 1000 men, and there are about 4000 more in the Philippines. The viceroy is by his office captain-general, with a ſalary of about 2000 pieces of eight.

MANILIUS (Marcus), a Latin poet, whoſe poem had the ill luck to lie buried in ſome German libraries, and was not heard of in the world until Poggius, about two centuries ago, publiſhed him from ſome old manuſcripts he found there. There is no account to be found of him but what can be drawn from his poem, which is called *Aſtronomicon*: and contains a ſyſtem of the ancient aſtronomy and aſtrology, together with the philoſophy of the Stoics. It conſiſts of five books; though there was a ſixth, which has not been recovered. From the ſtyle, and no mention of the author being found in ancient writers, it is probable he died young. It is collected, however, that he was a Roman of illuſtrious extraction, and lived under the reign of Auguſtus, whom he invokes, though not by name, yet by circumſtances and character that ſuit no other emperor. The beſt editions of Manilius are, that of Joſeph Scaliger in 1600, and that of Bently at London in 1738.

MANILLE, in commerce, a large braſs ring in the form of a bracelet, either plain or engraven, flat or round.

Manilles are the principal commodities which the Europeans carry to the coaſt of Africa, and exchange with the natives for ſlaves. Theſe people wear them as ornaments on the ſmall of the leg, and on the thick part of the arm above the elbow. The great men wear manilles of gold and ſilver: but theſe are made in the country by the natives themſelves.

MANIOC, or MANIHOT. See JATROPHA.

MANIPULUS, MANIPULE, among the Romans, was a little body of infantry, which in the time of Romulus conſiſted of 100 men: and in the time of the conſuls, and firſt Cæſars, of 200.

The word properly ſignifies "a handful;" and, according to ſome authors, was firſt given to the handful of hay which they bore at the end of a pole, to diſtinguiſh themſelves by, before the cuſtom was introduced of bearing an eagle for their enſign; and hence alſo the phraſe, *a handful of men*. But Vegetius, Modeſtus, and Varro, gave other etymologies of the word: the laſt derives it from *manus*, a little body of men following the ſame ſtandard. According to the former, this was called *manipulus*, becauſe they fought hand in hand or all together: *Contubernium autem manipulus vocabatur ab eo, quod conjunctis manibus pariter dimicabant.*

Each manipule had two centurions, or captains, called *manipularii*, to command it; one whereof was lieutenant to the other. Each cohort was divided into three manipules, and each manipule into two centuries.

Aulus Gellius quotes an old author, one Cincius, who lived in the time of Hannibal (whoſe priſoner he was), and who, writing on the art of war, obſerves, that then each legion conſiſted of 60 centuries, of 30 manipules, and of ten cohorts. And again, Varro and Vegetius mention it as the leaſt diviſion in the army, only conſiſting of the tenth part of a century; and Spartian adds, that it contained no more than ten men. This ſhows that the manipulus was not always the ſame thing.

MANIPULUS is alſo an eccleſiaſtical ornament worn by the prieſts, deacons, and ſubdeacons in the Romiſh church. It conſiſts of a little fillet in form of a ſtole, three or four inches broad, and made of the ſame ſtuff with the chaſuble: ſignifying and repreſenting an handkerchief which the prieſts in the primitive church wore on the arm to wipe off the tears they were continually ſhedding for the ſins of the people. There ſtill remains a mark of this uſage in a prayer rehearſed by thoſe who wear it; *Merear, Domine portare manipulum fletus & doloris.*— The Greeks and Maronites wear two manipules, one on each arm.

MANIPULUS, among phyſicians, is uſed to ſignify a handful of herbs or leaves, or ſo much as a man can graſp in his hand at once; which quantity is freqently denoted by the abbreviature, M, or m.

MANIS, the SCALY LIZARD, in zoology; a genus of quadrupeds belonging to the order of bruta, the characters of which are theſe: They have no foreteeth either in the upper or under jaw; the tongue is long and cylindrical; the ſnout is long and narrow; and the body is covered with hard ſcales. There are two ſpecies: 1. The pentadactyla, or ſhort-tailed manis, with five toes on each foot. The head is ſmaller than the neck; the eyes are very ſmall; the length of the body, including the tail, is from ſix to eight feet. The whole body is covered with hard ſcales, excepting the under-part of the head and neck, the breaſt, the belly, and the internal ſide of each leg. Betwixt the ſcales of this animal there are ſome hairs like the briſtles of a hog, browniſh at the points. The ſcales are of a reddiſh colour, very hard, convex above, and concave below. All the parts which want ſcales are naked. The ſcales are unconnected: and the animal can raiſe or lower them at pleaſure, like the quills of the porcupine. When irritated, he erects his ſcales and rolls himſelf up like a hedge-hog. In this ſituation, neither the lion, tiger, nor any other animal can hurt him. It is ſaid to deſtroy the elephant by twiſting itſelf round his trunk, and compreſſing that tender organ with its hard ſcales. It feeds on lizards and inſects; turns up the ground with its noſe; walks with its claws bent under its feet; grows very fat; and is eſteemed delicate eating; makes no other noiſe than a kind of ſnorting. It is a mild inoffenſive creature, is ſlow of motion, and has no other method of eſcaping the purſuit of man, but by concealing himſelf in crannies of rocks, and in holes which they dig in the ground, and where they likewiſe bring forth their young. It is a native of the Eaſt Indies, and is very rare. Mr Pennant conjectures that it may be a native

Plate CCLXXIX.

of Guinea; the *quogeli* of the Negroes, which, Des Marchais ſays, grows to the length of eight feet, of which the tail is four. It lives in woods and marſhy places; feeds on ants, which it takes by laying its long tongue acroſs their paths, which is covered with a viſcous ſaliva, ſo that the inſects which attempt to paſs over it cannot extricate themſelves.

2. The tetradactyla, or long-tailed manis, with four toes on each foot. This ſpecies is very ſimilar to the former; only the tail of it is much longer in proportion to the body; and ſuch parts as want ſcales, inſtead of being naked, are covered with a ſoft hair. It inhabits Guinea, and is alſo found in the Eaſt Indies.

MANLEY (Mrs), the celebrated writer of the *Atalantis*, was the daughter of Sir Roger Manley, the reputed author of the firſt volume of the *Turkiſh Spy*. She loſt her parents very early; and after having been deluded into a falſe marriage by her guardian, who was her couſin, and afterwards deſerted her, ſhe was patronized by the ducheſs of Cleveland, miſtreſs of Charles II. But the ducheſs, being a woman of a very fickle temper, grew tired of Mrs Manley in ſix months time; and diſcharged her upon a pretence, whether groundleſs or not is uncertain, that ſhe intrigued with her ſon. After this ſhe wrote her firſt tragedy, called *Royal Miſchief*, which was acted with great applauſe in 1696; and her apartment being frequented by men of wit and gaiety, ſhe ſoon engaged in amours, and was taken into keeping. Her pen now grew as licentious as her conduct: for, in her retired hours, ſhe wrote four volumes, called *Memoirs of the New Atalantis*; in which ſhe was not only very free in her wanton tales of love-adventures, but ſatirized the characters of many diſtinguiſhed perſonages, eſpecially thoſe who had a principal concern in the Revolution. A proſecution was commenced againſt her for this work; but whether thoſe in power were aſhamed to bring a woman to trial for a few amorous trifles, or whether the laws could not reach her diſguiſed ſatire, ſhe was diſcharged; and a total change of the miniſtry enſuing. Mrs Manley lived in high reputation and gaity, amuſing herſelf with the converſation of wits, and writing plays, poems, and letters. She died in 1724.

MANLIUS (Capitolinus), the renowned Roman conſul and general, who ſaved the capital when it was attacked by the Gauls in the night; he was alarmed by the cries of geeſe, which were ever after held ſacred. But being afterwards accuſed of aſpiring at the ſovereignty, he was thrown from the Tarpeian rock. See Gaul and Rome.

Manlius (Torquatus), a celebrated conſul and Roman captain; had great wit, but a difficulty in expreſſing himſelf, which induced Manlius Imperioſus, his father, to keep him almoſt by force in the country. Pompey, tribune of the people, enraged at this inſtance of ſeverity, formed a deſign of accuſing Manlius the father before the judges; but Torquatus being informed of it, went to that tribune, and, with a poniard in his hand, made him ſwear that he would not proceed in that accuſation againſt him to whom he owed his life. At length Torquatus was made military tribune, and killed a ſoldier of the Gauls in ſingle combat, from whom he took a gold chain that he wore about his neck. From this action he obtained the name of *Torquatus*. He was conſul in the war againſt the Latins; when he ordered his own ſon to be beheaded, for fighting contrary to his orders, though he had gained the victory. He conquered the enemies of the republic, and was ſeveral times made conſul; but at laſt refuſed the conſulſhip, ſaying, That it was no more poſſible for him to bear with the vices of the people, than it was for the people to bear with his ſeverity.

MANNA, in the materia medica, the juice of certain trees of the aſh kind*, either naturally concreted on the plants, or exſiccated and purified by art. There are ſeveral ſorts of manna in the ſhops. The larger pieces, called *flake manna*, are uſually preferred; though the ſmaller grains are equally good, provided they are white, or of a pale yellow colour; very light, of a ſweet, not unpleaſant taſte, and free from any viſible impurities. Some people injudiciouſly prefer the fat honey-like manna to the foregoing; this has either been expoſed to a moiſt air, or damaged by ſea or other water. This kind of manna is ſaid to be ſometimes counterfeited by a compoſition of ſugar and honey mixed with a little ſcammony; there is alſo a fictitious manna, which is white and dry, ſaid to be compoſed of ſugar, manna, and ſome purgative ingredient, boiled to a proper conſiſtence. This may be diſtinguiſhed by its weight, ſolidity, untranſparent whiteneſs, and by its taſte, which is different from that of manna.

*See Manna-*Tree*, below.

Manna is a mild, agreeable laxative; and may be given with ſafety to children and pregnant women: nevertheleſs, in ſome particular conſtitutions, it acts very unkindly, producing flatulencies and diſtenſions of the viſcera: theſe inconveniencies may be prevented by the addition of any grateful warm aromatic. It operates ſo weakly, that it does not produce the full effect of a cathartic, unleſs taken in large doſes; and hence it is rarely given in this intention by itſelf. It may be commodiouſly diſſolved in the purging mineral waters, or joined to the cathartic ſalts, ſenna, rhubarb, or the like. Geoffroy recommends acuating it with a few grains of emetic tartar; by this management, he ſays, bilious ſerum will be plentifully evacuated, without any nauſea, gripes, or other inconvenience. It is remarkable, that the efficacy of this drug is greatly promoted (if the account of Valliſnieri is to be relied on) by a ſubſtance which is itſelf very ſlow of operation, *viz.* caſia. See Cassia.

Manna, is alſo a Scripture-term, ſignifying a miraculous kind of food which fell from heaven for the ſupport of the Iſraelites in their paſſage through the wilderneſs, being in form of coriander-ſeeds, its colour like that of bdellium, and its taſte like honey.

The Scripture gives to manna the name of the *bread of heaven*, and the *food of angels*, Pſal. lxxviii. 25. whether it would inſinuate to us, that the angels ſent and prepared this food, or that angels themſelves, if they had need of any food, could not have any that was more agreeable than manna was. The author of the Book of Wiſdom ſays, xvi. 20. 21. that manna ſo accommodated itſelf to every one's taſte, that every one found it pleaſing to him; and that it included every thing that was agreeable to the palate and fit for good nouriſhment; which expreſſion ſome have taken in the literal ſenſe, though others underſtand them figuratively.

The critics are divided about the original of the word *manna*. Some think that *man* is put inſtead of the Hebrew word *mah*, which ſignifies "What is this? and that the Hebrews, then firſt ſeeing that new food which God had ſent them, cried to one another, מנהוא *man-hu*, inſtead of *mah-hu*, "What is this?" Others maintain, that the Hebrews very well knew before what manna was; and that, ſeeing it in great abundance about their camp, they ſaid to one to another, *Man-hu*, "This is manna." Mr Saumaiſe and ſome other moderns are of this laſt opinion. They imagine, that the manna which God ſent the Iſraelites was nothing elſe but that fat and thick dew which ſtill falls in Arabia, which preſently condenſed, and ſerved for food to the people; that this is the ſame thing as the wild honey, mentioned Matt. iii. 4. wherewith John the Baptiſt was fed; and that the miracle of Moſes did not conſiſt in the production of any new ſubſtance, but in the exact and uniform manner in which the manna was diſpenſed by Providence for the maintenance of ſuch a great multitude.

On the contrary, the Hebrews and Orientals believe, that the fall of the manna was wholly miraculous. The Arabians call it the *ſugar-plums of the Almighty*; and the Jews are ſo jealous of this miracle, that they pronounce a curſe againſt all ſuch as preſume to deny the interpoſition of a miraculous power.

Our tranſlation, and ſome others, make Moſes fall into a plain contradiction in relating this ſtory of the manna, which they render thus: "And when the children of Iſrael ſaw it, they ſaid one to another, It is manna; for they wiſt not what it was." Exodus xvi. 15. Whereas the Septuagint, and ſeveral authors both ancient and modern, have tranſlated the text according to the original, "The Iſraelites ſeeing this, ſaid one to another, What is this? for they knew not what it was." For we muſt obſerve, that the word by which they aſked, *what this is?* was in their language *man*, which ſignifies likewiſe meat ready provided; and therefore it was always afterwards called *man* or *manna*.

Whether this manna had thoſe extraordinary qualities in it or no, which ſome imagine, it muſt be allowed to be truly miraculous, upon the following accounts. 1. That it fell but ſix days in the week. 2. That it fell in ſuch a prodigious quantity, as ſuſtained almoſt three millions of ſouls. 3. That there fell a double quantity every Friday, to ſerve them for the next day, which was their Sabbath. 4. That what was gathered on the firſt five days ſtunk and bred worms if kept above one day: but that which was gathered on Friday kept ſweet for two days. And laſtly, That it continued falling while the Iſraelites abode in the wilderneſs, but ceaſed as ſoon as they came out of it and had got corn to eat in the land of Canaan.

MANNA-Tree, is a ſpecies of the aſh †, and a native of Calabria in Italy. The ſhoots of this tree are much ſhorter, and the joints cloſer together, than thoſe of the common aſh; the ſmall leaves are ſhorter, and deeper ſawed on their edges, and are of a lighter green. The flowers come out from the ſide of the branches, which are of a purple colour, and appear in the ſpring before the leaves come out. This tree is of humble growth, ſeldom riſing more than 15 or 16 feet high in Britain.

A great quantity of fine manna is gathered at Carini in Sicily, oozing from a kind of aſh-tree with a bark ſimilar to that of the ebony, and a leaf ſomewhat like the acacia. M. de Non*, who gives an account of this manna, ſays, that it is produced from young trees about ſeven or eight years old when they are only about eight feet high. Inciſions are then made horizontally in the bark, and from theſe the manna flows. The inciſions are made from the earth to the top of the tree, and are repeated every two days from the end of July till the circulation is ſtopped in the courſe of the year, or till the manna becomes worſe in quality. It exſudes firſt as a white frothy liquor extremely light, pleaſant to the taſte, and of an agreeable flavour, which is coagulated by the heat of the ſun, and aſſumes an appearance ſomewhat reſembling ſtalactites. This is the beſt kind, and by the people of that country is called *lachrymatory* or *cane* manna. The inferior kind appears firſt in the form of a glutinous and higher coloured liquor, which is received on the leaves of the Indian fig, which are placed for that purpoſe at the foot of the tree. This alſo congeals by the heat of the ſun; though it is more heavy, purgative, and of much leſs value than the former. It is called *fat* manna: In this part only reſides the faint and diſagreeable flavour obſervable in manna; for the cane manna is of an agreeable flavour, and is an excellent ſtomachic. It is got off from the bark of the tree by bending and ſhaking it. In rainy ſeaſons, they muſt gather the manna every day, which both leſſens the quantity and renders it of inferior quality. When the ſtem of the tree is entirely covered with inciſions, they cut it down cloſe to the ground; after which it puſhes out new tufts of wood, one or two ſtems of which are preſerved, and at a proper age produce manna as before. The tree itſelf is propagated by ſeed, and afterwards tranſplanting it. The wood is hard and heavy, of a bitter taſte, and recommended in the dropſy. It thrives only in hot climates, and requires to be expoſed to the north winds in order to make it productive; but M. de Non is of opinion, that it might be propagated, and would produce manna in Provence in France. The Sicilian manna is dearer and more eſteemed than that of Calabria, though the latter is more generally known and cultivated. The tree does not grow in any other part of the iſland excepting about Carini, where it is a native.

MANNER, in painting, a habitude that a man acquires in the three principal parts of painting, the management of colours, lights, and ſhadows; which is either good or bad according as the painter has practiſed, more or leſs after the truth, with judgment and ſtudy. But the beſt painter is he who has no manner at all. The good or bad choice he makes is called *goute*.

MANNERS, the plural noun, has various ſignifications; as, the general way of life, the morals, or the habits, of any perſon or people; alſo ceremonious behaviour, or ſtudied civility. See the next article.

† See *Fraxinus*.

* *Travels in Sicily*.

Good-Manners, according to Swift, is the art of making thoſe people eaſy with whom we converſe.

Whoever makes the feweſt perſons uneaſy, is the beſt bred in the company.

As the beſt law is founded upon reaſon, ſo are the beſt manners. And as ſome lawyers have introduced unreaſonable things into common law; ſo likewiſe many teachers have introduced abſurd things into common good-manners.

One principal point of this art is to ſuit our behaviour to the three ſeveral degrees of men; our ſuperiors, our equals, and thoſe below us.

For inſtance, to preſs either of the two former to eat or drink is a breach of manners; but a tradeſman or a farmer muſt be thus treated, or elſe it will be difficult to perſuade them that they are welcome.

Pride, ill-nature, and want of ſenſe, are the three great ſources of ill-manners: without ſome one of theſe defects, no man will behave himſelf ill for want of experience; or of what, in the language of fools, is called *knowing the world*.

“ I defy (proceeds our author) any one to aſſign an incident wherein reaſon will not direct us what we are to ſay or do in company, if we are not miſled by pride or ill-nature. Therefore, I inſiſt that good ſenſe is the principal foundation of good-manners; but becauſe the former is a gift which very few among mankind are poſſeſſed of, therefore all the civilized nations of the world have agreed upon fixing ſome rules for common behaviour, beſt ſuited to their general cuſtoms, or fancies, as a kind of artificial good-ſenſe to ſupply the defects of reaſon. Without which, the gentlemany part of dunces would be perpetually at cuffs, as they ſeldom fail when they happen to be drunk, or engaged in ſquabbles about women or play. And, God be thanked, there hardly happeneth a duel in a year, which may not be imputed to one of thoſe three motives. Upon which account, I ſhould be exceedingly ſorry to find the legiſlature make any new laws, againſt the practice of duelling; becauſe the methods are eaſy, and many, for a wiſe man to avoid a quarrel with honour, or engage in it with innocence. And I can diſcover no political evil, in ſuffering bullies, ſharpers, and rakes, to rid the world of each other by a method of their own, where the law hath not been able to find an expedient.

“ As the common forms of good-manners were intended for regulating the conduct of thoſe who have weak underſtandings; ſo they have been corrupted by the perſons for whoſe uſe they were contrived. For theſe people have fallen into a needleſs and endleſs way of multiplying ceremonies, which have been extremely troubleſome to thoſe who practiſe them, and inſupportable to every body elſe; inſomuch that wiſe men are often more uneaſy at the over-civility of theſe refiners, than they could poſſibly be in the converſation of peaſants or mechanics.

“ The impertinencies of this ceremonial behaviour are nowhere better ſeen than at thoſe tables where ladies preſide, who value themſelves upon account of their good-breeding; where a man muſt reckon upon paſſing an hour without doing any one thing he hath a mind to, unleſs he will be ſo hardy as to break thro' all the ſettled decorum of the family. She determines what he loveth beſt, and how much he ſhall eat; and if the maſter of the houſe happeneth to be of the ſame diſpoſition, he proceedeth in the ſame tyrannical manner to preſcribe in the drinking part: at the ſame time you are under the neceſſity of anſwering a thouſand apologies for your entertainment. And although a good deal of this humour is pretty well worn off among many people of the beſt faſhion, yet too much of it ſtill remaineth, eſpecially in the country; where an honeſt gentlemen aſſured me, that having been kept four days againſt his will at a friend's houſe, with all the circumſtances of hiding his boots, locking up the ſtable, and other contrivances of the like nature, he could not remember, from the moment he came into the houſe to the moment he left it, any one thing wherein his inclination was not directly contradicted; as if the whole family had entered into a combination to torment him.

“ But, beſides all this, it would be endleſs to recount the many fooliſh and ridiculous accidents I have obſerved among theſe unfortunate proſelytes to ceremony. I have ſeen a ducheſs fairly knocked down by the precipitancy of an officious coxcomb running to ſave her the trouble of opening a door. I remember, upon a birth-day at court, a great lady was rendered utterly diſconſolate, by a diſh of the ſauce let fall by a page directly upon her head-dreſs and brocade, while ſhe gave a ſudden turn to her elbow upon ſome point of ceremony with the perſon who ſat next her. Monſieur Buys, the Dutch envoy, whoſe politics and manners were much of a ſize, brought a ſon with him about 13 years old to a great table at court. The boy and his father, whatever they put on their plates, they firſt offered round in order, to every perſon in the company; ſo that we could not get a minute's quiet during the whole dinner. At laſt their two plates happened to encounter and with ſo much violence, that, being china, they broke in 20 pieces, and ſtained half the company wlth wet ſweetmeats and cream.

“ There is a pedantry in manners as in all arts and ſciences, and ſometimes in trades. Pedantry is properly the over-rating any kind of knowledge we pretend to. And if that kind of knowledge be a trifle in itſelf, the pedantry is the greater. For which reaſon, I look upon fiddlers, dancing-maſters, heralds, maſters of the cermony, &c. to be greater pedants than Lipſius, or the elder Scaliger. With theſe kind of pedants the court, while I knew it, was always plentifully ſtocked, I mean from the gentleman-uſher (at leaſt) incluſive, downward to the gentleman porter; who are, generally ſpeaking, the moſt inſignificant race of people that this iſland can afford, and with the ſmalleſt tincture of good-manners, which is the only trade they profeſs. For being wholly illiterate, converſing chiefly with each other, they reduce the whole ſyſtem of breeding within the forms and circles of their ſeveral offices: and as they are below the notice of miniſters, they live and die in court under all revolutions, with great obſequiouſneſs to thoſe who are in any degree of credit or favour, and with rudeneſs and inſolence to every body elſe. From whence I have long concluded that good-manners are not a plant of the court-growth: for if they were, thoſe people who have underſtandings directly of a level for ſuch acquirements, and who have ſerved ſuch long apprenticeſhips to nothing elſe, would certainly have picked them up. For as to the

great

great officers who attend the prince's perſon or councils, or preſide in his family, they are a tranſient body, who have no better a title to good-manners than their neighbours, nor will probably have recourſe to gentlemen-uſhers for inſtruction. So that I know little is to be learned at court on this head, except in the material circumſtance of dreſs: wherein the authority of the maids of honour muſt indeed be allowed to be almoſt equal to that of a favourite actreſs.

"I remember a paſſage my lord Bolinbroke told me: That going to receive prince Eugene of Savoy at his landing, in order to conduct him immediately to the queen, the prince ſaid he was much concerned that he could not ſee her majeſty that night: for Monſieur Hoffman (who was then by) had aſſured his highneſs, that he could not be admitted into her preſence with a tied up periwig: that his equipage was not arrived: and that he had endeavoured in vain to borrow a long one among all his valets and pages. My lord turned the matter to a jeſt, and brought the prince to her majeſty: for which he was highly cenſured by the whole tribe of gentlemen-uſhers, among whom Monſieur Hoffman, an old dull reſident of the emperor's, had picked up this material point of ceremony; and which, I believe, was the beſt leſſon he had learned in 25 years reſidence.

"I make a difference between *good-manners* and *good breeding*; although, in order to vary my expreſſion, I am ſometimes forced to confound them. By the firſt, I only underſtand the art of remembring and applying, certain ſettled forms of general behaviour. But *good-breeding* is of a much larger extent: for beſides an uncommon degree of literature ſufficient to qualify a gentleman for reading a play, or a political pamphlet, it taketh in a great compaſs of knowledge; no leſs than that of dancing, fighting, gaming, making the circle of Italy, riding the great horſe, and ſpeaking French; not to mention ſome other ſecondary or ſubaltern accompliſhments, which are more eaſily acquired. So that the difference between good-breeding and good-manners lieth in this, That the former cannot be attained to by the beſt underſtandings, without ſtudy and labour: whereas a tolerable degree of reaſon will inſtruct us in every part of good-manners without other aſſiſtance.

"I can think of nothing more uſeful upon this ſubject, than to point out ſome particulars wherein the very eſſentials of good-manners are concerned, the neglect or perverting of which doth very much diſturb the good commerce of the world, by introducing a traffic of a mutual uneaſineſs in moſt companies.

"Firſt, a neceſſary part of good-manners is a punctual obſervance of time at our own dwellings, or thoſe of others, or at third places, whether upon matters of civility, buſineſs, or diverſion; which rule, though it be a plain dictate of common reaſon, yet the greateſt miniſter† I ever knew, was the greateſt treſpaſſer againſt it; by which all his buſineſs doubled upon him, and placed him in a continual arrear. Upon which I often uſed to rally him as deficient in point of good-manners. I have known more than one ambaſſador, and ſecretary of ſtate, with a very moderate portion of intellectuals, execute their office with great ſucceſs and applauſe, by the mere force of exactneſs and regularity. If you duly obſerve time for the ſervice of another, it doubles the obligation; if upon your own account, it would be manifeſt folly, as well as ingratitude to neglect it; if both are concerned, to make your equal or inferior attend on you to his own diſadvantage, is pride and injuſtice.

"Ignorance of forms cannot properly be ſtyled *ill-manners*: becauſe they are ſubject to frequent changes; and conſequently not being founded upon reaſon, are beneath a wiſe man's regard. Beſides, they vary in every country; and after a ſhort period of time vary frequently in the ſame: ſo that a man who travelleth, muſt needs be at firſt a ſtranger to them in every court through which he paſſeth; and perhaps, at his return, as much a ſtranger in his own; and, after all, they are eaſier to be remembered or forgotten than faces or names.

"Indeed, among the many impertinencies that ſuperficial young men bring with them from abroad, this bigotry of forms is one of the principal, and more predominant than the reſt; who look upon them not only as if they were matters capable of admitting of choice, but even as points of importance; and therefore are zealous upon all occaſions to introduce and propagate the new forms and faſhions they have brought back with them: ſo that, uſually ſpeaking, the worſt-bred perſon in the company is a young traveller juſt arrived from abroad."

† Harley earl of Oxford, lord high treaſurer to Queen Ann.

MANNORY (Lewis), late advocate of the parliament of Paris, where he was born in 1696, and died in 1777. From him we have 18 vols 12mo of *Pleadings* and *Memoirs*. A great number of ſingular caſes occur in this collection: and the author has the talent of rendering them more ſtriking by the agreeable manner in which they are ſtated. He was Travenel's counſel in his proceſs againſt Voltaire, and was very ſatirical againſt that poet. The latter took revenge by deſcribing him as a mercenary babbler, who ſold his pen and his abuſe to the higheſt bidder.—Whatever may be the caſe, Mannory would certainly have been more eſteemed both as an advocate and as a writer, if he had paid more attention to his ſtyle, and had been leſs prolix: if he had thought more deeply, and been more ſparing of his pleaſantry in cauſes where nothing was required but knowledge and ſound reaſoning. He publiſhed alſo a tranſlation into French of Father Peare's funeral Oration on Louis XIV. and very judicious Obſervations on the Semiramis of Voltaire. In company Mannory was full of wit and ſpirit, but ſometimes a little too cutting and ſevere.

MANŒUVRE, in a military ſenſe, conſiſts ſolely in diſtributing equal motion to every part of a body of troops, to enable the whole to form, or change their poſition in the moſt expeditious and beſt method, to anſwer the purpoſe required of a battalion, brigade, or line of cavalry, artillery, or infantry. It has always been lamented, that men have been brought on ſervice without being informed of the uſes of the different manœuvres they have been practiſing; and, having no ideas of any thing but the uniformity of the parade, inſtantly fall into diſorder and confuſion when they loſe the ſtep, or ſee a deviation from the ſtraight lines they have been accuſtomed to at exerciſe. It is a pity to ſee ſo much attention given to ſhow, and ſo little to inſtruct the troops in what may be of uſe to them in real ſervice. No manœuvre ſhould be executed in preſence of the enemy, unleſs protected by ſome diviſion of the troops.

MANOMETER, or MANSCOPE, an inſtrument to ſhow or meaſure the alterations in the rarity or denſity of the air. The manometer differs from the barometer in this, That the latter only ſerves to meaſure the *weight* of the atmoſphere, or of the column of air over it; but the former, the denſity of the air in which it is found; which denſity depends not only on the weight of the atmoſphere, but alſo on the action of the heat and cold, &c. Authors, however, generally confound the two together; and Mr Boyle himſelf gives us a very good manometer of his contrivance, under the name of a *ſtatical barometer*, conſiſting of a bubble of thin glaſs, about the ſize of an orange, which, being counterpoiſed when the air was in a mean ſtate of denſity, by means of a nice pair of ſcales, ſunk when the atmoſphere became lighter, and roſe as it grew heavier.

Another kind of manometers were made uſe of by colonel Roy, in his attempts to correct the errors of the barometer, and are deſcribed in the Philoſophical Tranſactions, Vol. LXVII. p. 689. "They were (ſays he) of various lengths, from four to upwards of eight feet: they conſiſted of ſtraight tubes, whoſe bores were commonly from $\frac{1}{5}$th to $\frac{1}{27}$th of an inch in diameter. The capacity of the tube was carefully meaſured, by making a column of quickſilver, about three or four inches in length, move along it from one end to the other. Theſe ſpaces were ſeverally marked, with a fine-edged file, on the tubes; and transferred from them to long ſlips of paſteboard, for the ſubſequent conſtruction of the ſcales reſpectively belonging to each. The bulb, attached to one end of the manometer at the glaſs-houſe, was of the form of a pear, whoſe point being occaſionally opened, dry or moiſt air could be readily admitted, and the bulb ſealed again, without any ſenſible alteration in its capacity.

"The air was confined by means of a column of quickſilver, long or ſhort, and with the bulb downward or upwards, according to the naure of the propoſed experiment. Here it muſt be obſerved, that, from the adheſion of the quickſilver to the tube, the inſtrument will not act truly, except it be in a vertical poſition; and even then it is neceſſary to give it a ſmall degree of motion, to bring the quickſilver into its true place; where it will remain in equilibrio, between the exterior preſſure of the atmoſphere on one ſide, and the interior elaſtic force of the confined air on the other.

"Pounded ice and water were uſed to fix a freezing point on the tube; and by means of ſalt and ice, the air was farther condenſed, generally four, and ſometimes five or ſix degrees below zero. The thermometer and manometer were then placed in a tin veſſel among water, which was brought into violent ebullition; where having remained a ſufficient time, and motion being given to the manometer, a boiling point was marked thereon. After this the fire was removed, and the gradual deſcents of the piece of quickſilver, correſponding to every 20 degrees of temperature in the thermometer, were ſucceſſively marked on a deal rod applied to the manometer. It is to be obſerved, that both inſtruments, while in the water were in circumſtances perfectly ſimilar; that is to ſay, the ball and bulb were at the bottom of the veſſel.

"In order to be certain that no air had eſcaped by the ſide of the quickſilver during the operation, the manometer was frequently placed a ſecond time in melting ice. If the barometer had not altered between the beginning and end of the experiment, the quickſilver always became ſtationary at or near the firſt mark. If any ſudden change had taken place in the weight of the atmoſphere during that interval, the ſame was noted, and allowance made for it in afterwards proportioning the ſpaces.

"Long tubes, with bores truly cylindrical, or of any uniform figure, are ſcarcely ever met with. Such however as were uſed in theſe experiments, generally tapered in a pretty regular manner from one end to the other. When the bulb was downwards, and the tube narrowed that way, the column of quickſilver confining the air lengthened in the lower-half of the ſcale, and augmented the preſſure above the mean. In the upper half, the column being ſhortened, the preſſure was diminiſhed below the mean. In this caſe, the obſerved ſpaces both ways from the centre were diminiſhed in the inverſe ratio of the heights of the barometer at each ſpace, compared with its mean height. If the bore widened towards the bulb when downwards, the obſerved ſpaces, each way from the centre, were augmented in the ſame inverſe ratio; but in the experiments on air leſs denſe than the atmoſphere, the bulb being upwards, the ſame equation was applied with contrary ſigns; and if any extraordinary irregularity took place in the tube, the correſponding ſpaces were proportioned both ways from that point, whether high or low, that anſwered to the mean.

"The obſerved and equated manometrical ſpaces being thus laid down on the paſteboard containing the meaſures of the tube; the 212° of the thermometer, in exact proportion to the ſections of the bore, were conſtructed along-ſide of them: hence the coincidences with each other were eaſily ſeen; and the number of thermometrical degrees anſwering to each manometrical ſpace readily transferred into a table prepared for the purpoſe."

MANOR, MANERIUM, (*à manendo*, becauſe the uſual reſidence of the owner), ſeems to have been a diſtrict of ground held by lords or great perſonages; who kept in their own hands ſo much land as was neceſſary for the uſe of their families, which were called *terræ dominicales*, or *demeſne lands*; being occupied by the lord, or *dominus manerii*, and his ſervants. The other, or *tenemental* lands, they diſtributed among their tenants; which, from the different modes of tenure, were called and diſtinguiſhed by two different names.—Firſt, *book-land*, or charter-land, which was held by deed under certain rents and free ſervices, and in effect differed nothing from free ſocage lands: and from hence have ariſen moſt of the freehold tenants who hold of particular manors, and owe ſuit and ſervice to the ſame. The other ſpecies was called *folk-land*, which was held by no aſſurance in writing, but diſtributed among the common folk or people at the pleaſure of the lord, and reſumed at his diſcretion; being indeed land held in villenage. See VILLENAGE.

Blackſt. Comment.

The reſidue of the manor, being uncultivated, was termed

termed the *lord's waſte*, and ſerved for public roads, and for common of paſture to the lord and his tenants. Manors were formerly called *baronies*, as they ſtill are *lordſhips*; and each lord or baron was empowered to hold a domeſtic court, called the *court-baron*, for redreſſing miſdemeſnors and nuſances within the manor, and for ſettling diſputes of property among the tenants. This court is an inſeparable ingredient of every manor; and if the number of ſuitors ſhould ſo fail, as not to leave ſufficient to make a jury or homage, that is, two tenants at the leaſt, the manor itſelf is loſt.

In the early times of the legal conſtitution, the king's greater barons, who had a large extent of territory held under the crown, granted out frequently ſmaller manors to inferior perſons to be held of themſelves; which do therefore now continue to be held under a ſuperior lord, who is called in ſuch caſes the *lord paramount* over all theſe manors; and his ſeignory is frequently termed an *honour*, not a *manor*; eſpecially if it hath belonged to an ancient feodal baron, or hath been at any time in the hands of the crown. In imitation whereof, theſe inferior lords began to carve out and grant to others ſtill more minute eſtates, to be held as of themſelves, and were proceeding downwards *in infinitum*, till the ſuperior lords obſerved, that, by this method of ſubinfeudation, they loſt all their feodal profits of wardſhips, marriages, and eſcheats, which fell into the hands of theſe meſne or middle lords, who were the immediate ſuperiors of the *terre-tenant*, or him who occupied the land; and alſo that the meſne lords themſelves were ſo impoveriſhed thereby, that they were diſabled from performing their ſervices to their own ſuperiors. This occaſioned, firſt, that proviſion in the 32d chapter of *magna charta*, 9 Hen. III. (which is not to be found in the firſt charter granted by that prince, nor in the great charter of King John), that no man ſhould either give or ſell his land without reſerving ſufficient to anſwer the demands of his lord; and, afterwards, the ſtatute of Weſtm. 3. or *quia emptores*, 18 Edw. I. c. 1. which directs, that, upon all ſales, or feoffments of land, the feoffee ſhall hold the ſame, not of his immediate feoffor, but of the chief lord of the fee, of whom ſuch feoffor himſelf held it. But theſe proviſions not extending to the king's own tenants *in capite*, the like law concerning them is declared by the ſtatutes of *prærogativa regis*, 17 Edw. II. c. 6. and of 34 Edw. III. c. 15. by which laſt all ſubinfeudations, previous to the reign of king Edward I. were confirmed; but all ſubſequent to that period were left open to the king's prerogative. And from hence it is clear, that all manors exiſting at this day, muſt have exiſted as early as king Edward the Firſt: for it is eſſential to a manor, that there be tenants who hold of the lord; and, by the operation of theſe ſtatutes, no tenant *in capite* ſince the acceſſion of that prince, and no tenant of a common lord ſince the ſtatute of *quia emptores*, could create any new tenants to hold of himſelf. See VILLENAGE.

MANS, an ancient, rich, and populous town of France, capital of the county of Maine, with a biſhop's ſee. Its wax and ſtuffs are famous. It is ſeated on a high hill near the river Sarr, in E. Long. 0. 10. N. Lat. 47. 58. It is an earldom beſtowed on William Murray, chief juſtice of England, with remainder to the family of Stormont in Scotland.

MANSE, MANSUS, *Manſa* or *Manſum*; in ancient law-books, denotes an *houſe*, or habitation, either with or without land. See HOUSE, and MANSION. The word is formed *a manendo*, "abiding;" as being the place of dwelling or reſidence.

Capital MANSE *(Manſum Capitale)*, denotes the *manor-houſe*, or lord's court. See MANOR.

MANSUR *Preſbyteri*, is a parſonage or vicarage houſe for the incumbent to reſide in. This was originally, and ſtill remains, an eſſential part of the endowment of a pariſh-church, together with the glebe and tythes. It is ſometimes called *Preſbyterium*. See PRESBYTERY.

MANSFELD, a city of Germany, and capital of a county of the ſame name, in the circle of Upper Saxony. E. Long. 12. 55. N. Lat. 51. 35.

MANSFELD (Peter Erneſt, count of), was deſcended from one of the moſt illuſtrious families in Germany, and which has produced the greateſt number of diſtinguiſhed characters. In 1552, he was taken priſoner at Ivoy, where he commanded; and he was afterwards of great ſervice to the Catholics at the battle of Montcontour. In conſequence of his great talents, he was employed in affairs of the utmoſt delicacy and importance. Being made governor of Luxembourg, he maintained tranquillity in that province, while the reſt of the Low Countries was a prey to the horrors of civil war. In teſtimony of their gratitude, the States cauſed the following inſcription to be placed on the gate of the hotel de ville: *In Belgio omnia dum vaſtat civile bellum,* MANSFELDUS *bello et pace fidus, hanc provinciam in fide continet ſervatque illæſam, cum ſummo populi conſenſu et hilari jucunditate.* He was afterward appointed to the command of the Low Countries; and died at Luxembourg, March 21. 1604, at the age of 87, with the title of *Prince of the Holy Empire*. His mauſoleum in bronze, which is to be ſeen in the chapel bearing his name, and adjoining to the Church of the Recollets at Luxembourg, is an admirable work. Four highly finiſhed weepers, with which this monument was ornamented, were carried off by Louis XIV. when he took this city in 1684. To a love of war, Mansfeld united a taſte for the ſciences; and he was a lover and encourager of the arts: he poſſeſſed a great and elevated mind; but, like many heroes ancient and modern, he was greedy of gain and laviſh of blood. Abbé Schannat has written the hiſtory of the count of Mansfeld in Latin; printed at Luxembourg, 1707. Charles prince of Mansfeld, his lawful ſon, ſignalized himſelf in the wars of Flanders and Hungary; and died without iſſue in 1595, after having beaten the Turks who attempted to relieve the city of Gran (Strigonia), which he was beſieging.

MANSFELD (Erneſt de), the illegitimate ſon of Peter Erneſt by a lady of Malines, was educated at Bruſſels, in the principles of the Roman Catholic religion, by his godfather Earneſt archduke of Auſtria. He was employed in the ſervice of the king of Spain in the Low Countries, and in that of the emperor in Hungary, together with his brother Charles count of Mansfeld. He was legitimated on account of his

bravery

bravery by the emperor Rodolphus II.; but his father's poſts and poſſeſſions in the Spaniſh Netherlands having been refuſed him, contrary to promiſes which he had received, he, in 1610, joined the party of the Proteſtant princes. Being now become one of the moſt dangerous enemies of the houſe of Auſtria, who called him the *Attilla of Chriſtianity*, he ſet himſelf, in 1618, at the head of the rebels in Bohemia, and got poſſeſſion of Pilſen in 1619. Though his troops were defeated in ſeveral battles, he was able to penetrate into the palatinate He there took ſeveral places, ravaged Alſace, made himſelf maſter of Haguenau, and defeated the Bavarians. At length he was totally defeated by Walſtein, at the battle of Daſſou, which happened in the month of April 1626. He gave over his remaining troops to the Duke of Weimar, and intended to paſs into the Venetian States; but fell ſick in a village between Zara and Spalatro and there expired, A. D. 1626, aged 46. The procurator Nani thus deſcribes him; "He was bold, intrepid in danger, and the moſt ſkilful negociator of the age in which he lived. He poſſeſſed a natural eloquence, and well knew how to inſinuate himſelf into the hearts of thoſe whom he wiſhed to gain. He was greedy of others wealth, and prodigal of his own.—He was full of vaſt projects and great hopes, and yet poſſeſſed neither lands nor money at his death." He did not wiſh to die in his bed; but dreſſed himſelf in his fineſt robes, put on his ſword, and ſat up, leaning upon two domeſtics, and in this poſition, highly becoming a warrior, breathed his laſt. But of all the actions of this great captain and ſingular man, the following is without doubt the moſt extraordinary: Having got the moſt certain information that Cazel, in whom of all his officers he placed the greateſt confidence, had communicated his plans to the Auſtrian chief, he ſhowed neither paſſion nor reſentment at his treachery, but gave him 300 rix-dollars, and ſent him to count Buquoy, with a letter expreſſed in theſe words "Cazel being attached to you and not to me, I ſend him to you, that you may have the benefit of his ſervices." The opinions of men were divided about this action, and it was as much cenſured as applauded. Be this as it may, Erneſt is deſervedly eſteemed one of the greateſt generals of his age. There never was a leader more patient, more indefatigable, more inured to toil and hardſhip, to watchings, to cold, and to hunger. He raiſed armies, and ravaged the enemy's territories with an incredible celerity. The Hollanders ſaid of him, he was *bonus in auxilio, carus in pretio*; that is, that he rendered great ſervices to thoſe who employed him, but that he made them pay well for it.

Mansfeld (Henry-Francis, count of), was of the ſame houſe with the former, and ſignalized himſelf in the wars for the Spaniſh ſucceſſion. He died at Vienna on the 8th of June 1715, at the age of 74, after being a prince of the Holy Empire, a grandee of Spain, field-marſhal general of the emperor's armies general of artillery, ambaſſador to France and Spain, preſident of the Aulic council, and great chamberlain to the emperor.

MANSFIELD, a town of Nottinghamſhire, in England, ſeated in the foreſt of Sherwood, and 140 miles from London. It was anciently a royal demeſne. It has a market on Thurſdays, and two fairs. By an ancient cuſtom of this manor, the heirs were declared of age as ſoon as born. It is a well built town, and drives a great trade in malt. Its market is well ſtocked with corn, cattle, &c. Here is a charity-ſchool for 36 boys.

MANSIO, a term often mentioned in itineraries, denoting *inns* on the public roads to lodge in, at the diſtance of eighteen miles from each other; (Lactantius). Alſo, in the lower ages, it came to denote "an encampment for one night," (Lampridius).

Mansio, or *manſus*, was ſometimes alſo uſed in the ſame ſenſe with *hide*; that is, for as much land as one plough could till in a year. See Hide.

MANSION, Mansio, a dwelling-houſe, or habitation, eſpecially in the country. See Manse.

Mansio is more particularly uſed for the lord's chief dwelling-houſe within his fee; otherwiſe called the *capital meſſuage*, or chief manor place. See Manor.

MANSLAUGHTER, the unlawful killing of another, without malice either expreſs or implied: Which may be either Voluntarily, upon a ſudden heat; or involuntarily, but in the commiſſion of ſome unlawful act. Theſe were called, in the Gothic conſtitutions, *homicidia vulgaria; quæ aut caſu, aut etiam ſponte committuntur, ſed in ſubitaneo quodam iracundiæ calore et impetu.* And hence it follows, that in manſlaughter there can be no acceſſories before the fact; becauſe it muſt be done without premeditation.

1. As to the firſt, or voluntary branch: If upon a ſudden quarrel two perſons fight, and one of them kills the other, that is manſlaughter; and ſo it is, if they upon ſuch an occaſion go out and fight in a field: for this is one continued act of paſſion: and the law pays that regard to human frailty, as not to put a haſty and deliberate act upon the ſame footing with regard to guilt. So alſo if a man be greatly provoked, as by pulling his noſe, or other great indignity, and immediately kills the aggreſſor; though this is not excuſable *ſe defendendo*, ſince there is no abſolute neceſſity for doing it to preſerve himſelf; yet neither is it murder, for there is no previous malice: but it is manſlaughter. But in this, and in every other caſe of homicide upon provocation, if there be a ſufficient cooling-time for paſſion to ſubſide and reaſon to interpoſe, and the perſon ſo provoked afterwards kills the other, this is deliberate revenge and not heat of blood; and accordingly amounts to murder. So if a man takes another in the act of adultery with his wife, and kills him directly upon the ſpot; though this was allowed by the law of Solon, as likewiſe by the Roman civil law (if the adulterer was found in the huſband's own houſe) and alſo among the ancient Goths; yet in England it is not abſolutely ranked in the claſs of juſtifiable homicide, as in caſe of a forcible rape, but it is manſlaughter. It is however, the loweſt degree of it; and therefore in ſuch a caſe the court directed the burning in the hand to be gently inflicted, becauſe there could not be a greater provocation. Manſlaughter, therefore, on a ſudden provocation, differs from excuſable homicide *ſe defendendo* in this. That in one

caſe there is apparent neceſſity, for ſelf-preſervation, to kill the aggreſſor; in the other no neceſſity at all, being only a ſudden act of revenge.

2. The ſecond branch, or involuntary manſlaughter, differs alſo from homicide excuſable by miſadventure, in this: That miſadventure always happens in conſequence of a lawful act, but this ſpecies of manſlaughter in conſequence of an unlawful one. As if two perſons play at ſword and buckler, unleſs by the king's command, and one of them kills the other: this is manſlaughter, becauſe the original act was unlawful; but it is not murder, for the one had no intent to do the other any perſonal miſchief. So where a perſon does an act, lawful in itſelf, but in an unlawful manner, and without due caution and circumſpection; as when a workman flings down a ſtone or piece of timber into the ſtreet, and kills a man; this may be either miſadventure, manſlaughter, or murder according to the circumſtances under which the original act was done. If it were in a country village, where few paſſengers are, and he calls out to all people to have a care, it is miſadventure only: but if it were in London, or other populous towns, where people are continually paſſing, it is manſlaughter, though he gives loud warning; and murder, if he knows of their paſſing and gives no warning at all, for then it is malice againſt all mankind. And, in general, when an involuntary killing happens in conſequence of an unlawful act, it will be either murder or manſlaughter according to the nature of the act which occaſioned it. If it be in proſecution of a felonious intent, or in its conſequences naturally tending to bloodſhed, it will be murder; but if no more was intended than a mere civil treſpaſs, it will only amount to manſlaughter.

3. As to the puniſhment of this degree of homicide: The crime of manſlaughter amounts to felony, but within the benefit of clergy; and the offender ſhall be burnt in the hand, and forfeit all his goods and chattels.

But there is one ſpecies of manſlaughter, which is puniſhed as murder, the benefit of clergy being taken away from it by ſtatute: namely, the offence of mortally ſtabbing another, though done upon ſudden provocation. See Stabling.

MANSTEIN (Chriſtoper Herman of), was born at Peterſburg, Sept. 1. 1711, and for a long time ſerved with great diſtinction as a colonel in the Ruſſian armies. In 1745 he went into the ſervice of the king of Pruſſia; was appointed major-general of infantry in 1754; and diſtinguiſhed himſelf on all occaſions by his bravery and his knowledge of the art of war. He was wounded at the battle of Kolin, and ſoon after killed near Leutmeritz. He was univerſally regreted by thoſe who knew him; and even the enemy ſhed tears upon the occaſion.—Thoſe leiſure moments which the laborious profeſſion of war allowed him to enjoy, Manſtein dedicated to ſtudy. He was acquainted with almoſt all the languages of Europe. From him we have Hiſtorical, Political, and Military Memoirs of Ruſſia, (Lyons, 1772), 2 vols, 8vo, with plans and charts. Theſe memoirs commence with the death of Catharine I. 1727, and end in 1744. He was an eye-witneſs, or had a very intimate knowledge, of all the events contained in them. A ſupplement is added, which goes back to the times of the ancient Czars, and in particular treats to a conſiderable length on Peter I. At the concluſion of the work, the author gives an idea of the military and naval force, of the trade, &c. of this extenſive empire. The facts contained in this little hiſtorical tract, are not more intereſting in themſelves than they are valuable on account of the candor of the hiſtorian, who witneſſed every event which he relates. Mr Hume having received the original French of theſe memoirs, cauſed them to be tranſlated into Engliſh, and publiſhed at London; ſoon after there appeared a German tranſlation of them, publiſhed at Hamburgh. A French edition was publiſhed by M. Huber at Leipſic in 1771; and there appeared a new and enlarged edition in 1782.

MANTA, in ichthyology; a flat fiſh mentioned by Ulloa and others, as exceedingly hurtful to the pearl-fiſhers, and which ſeems to be the ſame with that which Pliny has deſcribed under the name of *nubes* or *nebula: Ipſi ferunt* (Urinatores) *et nubem quandam craſſeſcere ſuper capita, planorum piſcium ſimilem, prementem eos, arcentemque a reciprocando et ob ſtilos præacutos lineis annexos habere ſeſe; quia in ſi perfoſſæ ita, non recedant caliginis et pavoris, ut arbitror, opere. Nubem enim ſive nebulam* (*cujus nomine id malum appellunt*) *inter animalia haud ullam reperit quiſquam.* (Plin. Hiſtor. Nat. lib. ix. cap. 46.) The account given of this *cloud* by thoſe divers is much the ſame with that which the divers in the American ſeas give of the manta, and the name of the cloud is perfectly applicable to it, as it really ſeems to be a cloud to to thoſe who are in the water below it; the ſwimmers likewiſe carry long knives, or ſharp ſticks, for the purpoſe of diſperſing this animal. It is not improbable, that this fiſh has made its way into theſe ſeas from thoſe of the old word in the ſame manner as ſome others appear to have done. The ſtrength of this fiſh is ſo great, that it will not only ſtrangle a man whom it embraces or winds itſelf about, but it has been ſeen to take the cable of an anchor and move it from the place where it had been caſt. It has been called *manta*, becauſe, when it lies ſtretched upon the ſea, as it frequently does, it ſeems like a fleece of wool floating upon the water,

MANTE, a conſiderable town of France, capital of the Mantois; ſeated on the river Seine, in E. Long. 1. 45. N. Lat. 48 58.

MANTEGAR, or Man-tiger, as it is ſometimes written, in zoology, is the tufted ape, a ſpecies of ſimia. See Simia.

MANTEGNA (Andrew), was born in a village near Padua in 1451, and at firſt employed in keeping ſheep. It was obſerved, that inſtead of watching over his flock, he amuſed himſelf with drawing; and he was placed with a painter who, being delighted with his eaſe and taſte in work, and with his gentle and agreeable conduct in ſociety, adopted him for his ſon, and made him his heir. At the age of 17, Mantegna was employed to paint the altar of St Sophia in Padua, and the four evangeliſts. James Bellini, who admired his talents, gave him his daughter in marriage. Mantegna painted, for the duke of Mantua, the *Triumph of Cæſar*, which is the chief d'oeuvre of this painter, and has been engraved in claro-obſcuro, in nine plates. From reſpect to his extraordinary merit, the duke

made

made him knight of his order. The invention of engraving prints with the graver is commonly aſcribed to Mantegna, who died at Mantua in 1517.

MANTELETS, in the art of war, a kind of moveable parapets, made of planks about three inches thick, nailed one over another, to the height of almoſt ſix feet, generally caſed with tin, and ſet upon little wheels, ſo that in a ſiege they may be driven before the pioneers, and ſerve as blinds to ſhelter them from the enemy's ſmall ſhot.

MANTICHORA, in natural hiſtory, a name given by the Roman authors to a fierce and terrible creature, which they deſcribe from the Greeks, who call it ſometimes alſo *mantichora*; but when they write more correctly, *martichora* and *martiora*. We have formed the name *mar-tiger* on the ſound of the Roman name, tho' expreſſing a very different ſenſe; and our authors of the hiſtories of animals, figure to us under this name a terrible creature, partly from the accounts of Pliny exaggerated, and partly from their own imagination, with three rows of teeth, and with ſuch a ſhape as no animal ever poſſeſſed. See MANTEGARA.

The whole ſtory of this animal ſeems founded on the love of the wonderful; and very probably the *mantichora*, properly ſpeaking, was no other than ſome of the larger hyænas, which was at firſt ill deſcribed, and afterwards more and more wonders were added to the ſtory, till all ſhadow of truth was loſt.

MANTINEA (anc. geog,), a town ſituated in the ſouth of Arcadia, on the confines of Laconia (Ptolemy); called afterwards *Antigonea*, in honour of king Antigonus. It is memorable for a battle fought in its neighbourhood between the Thebans and Spartans, in which fell the celebrated commander Epaminondas. See THEBES.

MANTIS, in zoology, a genus of inſects belonging to the order of hemiptera, the characters of which are theſe: The head is unſteady, or appears from its continual nodding motion to be ſlightly attached to the thorax: the mouth is armed with jaws, and furniſhed with filiform palpi: The antennæ are ſetaceous. The four wings are membranaceous, and wrapped round the body: the under ones folded: The anterior or firſt pair of feet are compreſſed, armed on the under ſide with teeth like a ſaw, and terminated by a ſingle nail or crotchet: the four hindermoſt are greſſorii, or formed rather for advancing ſlowly than for performing quick movements: The thorax is extended to a conſiderable length, narrow, and throughout of equal ſize. The name *mantis*, given to this genus, denotes *ſoothſayer*: becauſe it has been imagined, that this inſect, by ſtretching out its fore feet, divined and pointed out thoſe things that were aſked of it. The inſect often reſts on its four hinder legs only, and holding the two fore ones raiſed up, joins them together, which has occaſioned its being called by the people of Languedoc, where it is very common, *pregadiou*, as if it prayed to God. The country folks moreover maintain, that this creature ſhows the way when aſked, becauſe it ſtretches thoſe ſame fore legs ſometimes to the right and ſometimes to the left; and indeed it is looked upon as an inſect almoſt ſacred, that muſt not be hurt. Its colour is all over of a browniſh green. The young ones have more of the green, the old more of the brown, caſt. It depoſits its eggs collected into a hemiſpherical parcel, flat on one ſide. There are in the parcel two rows of oblong eggs placed tranſverſely, and one row of ſhells placed longitudinally in form of a roof, one over the other, which cover the joining of the two rows of eggs. The whole parcel is light, and as it were compoſed of very thin parchment.

Barbut's Inſects, p. 106.

There are 53 ſpecies of this genus. In plate CCLXXIX is repreſented the gongylodes, the ſhape of which is extraordinary, being narrow and long. The head is ſmall, flat, with two filiform ſhort antennæ. On the ſides of the head are ſituated two large poliſhed eyes. The thorax is ſubciliated, long, narrow, margined, with a longitudinal riſing in the middle, and a tranſverſe depreſſion at one-third of its length. The elytra, which cover two thirds of the inſect, are veined, reticulated, croſſed one over the other, and cover the wings, which are veined, and diaphanous. The hinder legs are very long, the middle ones ſhorter; and the foremoſt pair of thighs are terminated with ſpines, the reſt winged, as it were, with membranaceous lobes. The top of the head has the ſhape of an awl; is membranaceous, often ſplit in two at the extremity. It is an inhabitant of China.

The inſects belonging to this genus, in their moſt perfect ſtate, are generally of very beautiful green colours, which ſoon fade, and become the colour of dead leaves. Their elytra bearing ſo ſtrong a reſemblance to the leaves of ſome plants, have procured them the name of *walking leaves*.

MANTLE, or *MANTLE-tree*, in architecture, the lower part of the chimney, or that piece of timber which is laid acroſs the jambs, and ſuſtains the compartments of the chimney-piece.

MANTLE, or *mantling*, in heraldry, that appearance of folding of cloth, flouriſhing, or drapery, which in any atchievment is drawn about a coat of arms. See HERALDRY, p. 464. Sect. V.

MANTO, in poetic hiſtory, the daughter of Tireſias, and like her father ſtrongly inſpired with prophecy. She was in ſo great eſteem, that when the Argives pillaged Thebes, they thought they could not acquit their vow to Apollo, of conſecrating to him the moſt precious thing in their plunder, without offering him this young woman. She was therefore ſent for the temple of Delphi. But this did not engage her in any vow of continency; or, if it did, ſhe obſerved it very ill; for ſhe bore a ſon called *Amphilocus* to Alcmeon, who had been generaliſſimo of the army which took Thebes; and a daughter to the ſame, named *Tiſiphone*. Theſe children were the fruits of an amour carried on during the madneſs which had ſeized Alcmeon, after he had put his mother to death. Virgil tranſports her into Italy, not for the ſake of ſecuring her virginity, but to produce a ſon of her who built Mantua.

MANTUA, anciently a town of the Tranſpadana in Italy, ſituated on the Mincius, a river running from the Lacus Benacus. It is ſaid to have been founded about 300 years before Rome by Banor or Ocnus, the ſon of Manto: and was the ancient capital of Etruria. When Cremona, which had followed the intereſt of Brutus, was given to the ſoldiers of Octavius, Mantua alſo, which was in the neighbourhood, ſhared the common calamity, and many of the inhabitants were tyranically deprived of their poſſeſſions. Virgil who was among them and a native of the town, applied for redreſs to Auguſtus, and obtained it by means of his poetical talents.

It is ſtill called Mantua, and is the capital of the duchy of that name. It is now a large place, having eight gates and about 16,000 inhabitants. The ſtreets are broad and ſtraight, and the houſes well built. It is very ſtrong by ſituation as well as by art; lying in the middle of a lake, or rather moraſs, formed by the river Minchio. There is no acceſs to the city but by two cauſeways which croſs this moraſs, and which are ſtrongly fortified ſo that the city is looked upon to be one of the moſt conſiderable fortreſſes of Europe; and the allies in 1745, though their army was in the duchy durſt not undertake the ſiege. It was greatly noted for its ſilk manufactures, which are now much decayed. The air in the ſummer-time is very unwholeſome. The celebrated poet Virgil was born at a village near this city. E. Long. 10. 47. N. Lat. 45. 10.

Mantua, the duchy of, a country of Italy, lying along the river Po, which divides it into two parts. It is bounded on the north by the Veroneſe: on the ſouth by the duchies of Reggio, Modena, and Miraldona; on the eaſt by the Ferrareſe; and on the weſt by the Cremoneſe. It is about 50 miles in length, and 25 in breadth; is fruitful in corn, paſtures, flax, fruits, and excellent wine. Charles IV. the laſt duke of Mantua, being a vaſſal of the empire took part with the French in the diſpute relating to the ſucceſſion of Spain; for which reaſon he was put under the ban of the empire, and died at Venice in 1708. He having no heirs the emperor kept the Mantuan in his own hands, and the duke of Savoy had Montferrat, which were confirmed to them by ſubſequent treaties. After the death of the emperor in 1740, his eldeſt daughter, now empreſs-queen, kept poſſeſſion of the Mantuan and the governor of the Milaneſe had the adminiſtration of affairs. The Mantuan comprehends the duchies of Mantua, Guaſtalla, and Sabioneta; the principalities of Caſtiglione, Solforino, and Boſolo; likewiſe the county of Novellara. The principal rivers are the Po, the Oglio, and the Minchio; and the principal town is Mantua.

MANTUAN (Baptiſt), a famous Italian poet born at Mantua in 1448. He took his name from the town; not having a right to that of his father, as being a natural ſon. In his youth, he applied himſelf to Latin poetry, which he cultivated all his life; for it does not appear that he wrote any thing in Italian. He entered among the Carmelites and became general of the order; though he quitted that dignity upon ſome diſguſt in 1515, and died the year following. The duke of Mantua, ſome years after, erected a marble ſtatue to his memory crowned with laurel, and placed it next to Virgil. His works were collected and publiſhed at Paris in three volumes folio in 1513. with the commentaries of St Murrhon, S. Brant, and I. Badius.

MANUAL, a word ſignifying any thing performed by the hand.

Manual (*Manuales*), in law, ſignifies what is employed or uſed by the hand, and whereof a preſent profit may be made: as ſuch a thing in the manual occupation of one is where it is actually uſed or employed by him.

Manual is the name of a ſervice-book uſed in the church of Rome, containing the rites, directions to the prieſts, and prayers uſed in the adminiſtration of baptiſm and other ſacraments; the form of bleſſing holy water, and the whole ſervice uſed in proceſſions.

Manual exerciſe, in the army, conſiſts in the obſervance of certain words of command appointed for this purpoſe.* When a regiment is drawn up, or paraded for exerciſe, the men are placed three deep, either by companies, or divided into platoons, with the grenadiers on the right. When ſoldiers are drawn up for exerciſe, the ranks and files ſhould be exactly even; and each ſoldier ſhould be inſtructed to carry his arms well, to keep his firelock ſteady and even upon his ſhoulder. with the right hand hanging down, and the whole body without conſtraint. The diſtances between files muſt be equal, and the ranks eight feet diſtant from each other. Every motion ſhould be performed with life, and the greateſt exactneſs obſerved in all the firings, wheelings, and marchings; and therefore a regiment ſhould never be under arms longer than two hours.

The following is an abſtract of the words of command at the manual exerciſe, with their explanation 1. *Poiſe your firelock*: i. e. Seize the firelock with your right hand, and turn the lock outwards, keeping the firelock perpendicular; then bring up the firelock with a quick motion from the ſhoulder, and ſeize it with the left hand, juſt above the lock, ſo that the fingers may lie upon the ſtock, with the elbows down, and the thumb upon the ſtock; the firelock muſt not be held too far from the body, and the left-hand muſt be of an equal height with the eyes. 2. *Cock your firelock:* i. e. Turn the barrel oppoſite to your face, and place your thumb upon the cock, raiſing your elbow ſquare at this motion; then cock your fire-lock, by drawing your elbow down, placing your right-thumb on the breech-pin, and the fingers under the guard. 3. *Preſent*; i. e. Step back about ſix inches to the rear with the right-foot, bringing the left-toe to the front; at the ſame time the butt end of the fire-lock muſt be brought to an equal height with the ſhoulder. placing the left-hand on the ſwell and the fore-finger of the right hand before the trigger, ſinking the muzzle a little. 4. *Fire*; i. e. Pull the trigger briſkly, and immediately after, bringing up the right foot to the inſide of the left, come to the priming poſition, with the lock oppoſite to the right-breaſt, the muzzle to the height of the hat, keeping it firm and ſteady; and at the ſame time ſeize the cock with the fore-finger and thumb of the right hand, the back of the hand being turned up. 5. *Half-cock your firelock* i. e. Half-bend the cock briſkly with a draw back of the right-elbow, bringing it cloſe to the butt of the fire-lock. 6. *Handle your Cartridge*; i. e. Bring your right hand with a ſhort round to your pouch, ſlapping it hard; ſeize the cartridge, and bring it with a quick motion to your mouth; bite the top well off and bring the hand as low as the chin, with the elbow down. 7. *Prime:* i. e. Shake the powder into the pan, placing the three laſt fingers behind the rammer with the elbow up. 8. *Shut your pans*; i. e. Shut your pans briſkly, drawing your right-arm at this motion towards your body, holding the cartridge faſt in your hand, as before; then turn the piece nimbly round to the loading poſition, with the lock to the front, and the muzzle to the height of the chin, bringing the right hand behind the muzzle, with both feet kept faſt in this motion. 9. *Charge with cartridge*: i. e. Turn up your hand, and put the cartridge into the muzzle, ſhaking the powder into the barrel; place your hand, cloſed, with a quick and ſtrong motion, upon the rammer. 10 *Draw your rammer*: i. e. Draw the rammer with a quick motion half out, ſeizing it at the muzzle back-handed; draw it quite out, turn it, and enter it into the muzzle. 11. *Ram down your charge*: i. e. Ram the cartridge well down in the barrel, inſtantly recovering and ſeizing the rammer back-handed at the centre, turning it, and entering it as far as the lower pipe, placing at the ſame time the edge of the hand on the butt end of the rammer, with fingers extended. 12. *Return your rammer*: i. e. Return the rammer, bringing up the piece with the left-hand to the ſhoulder, ſeizing it with the right-hand under the cock, keeping the left-hand faſt at the ſwell, turning the body ſquare to the front. 13. *Shoulder your firelock*: i. e. Quit the left-hand, and place it ſtrong upon the butt; quit the right hand, and throw it down the right-ſide. 14. *Reſt your firelock*: i. e. Seize the firelock with the right-hand, turning the lock outwards; raiſe the firelock from the ſhoulder, and place your left-hand with a quick motion above the lock, holding the piece right up and down in both hands before you, and your left-hand even with your eyes; ſtep briſkly back with your right-foot, placing it a hand's-breadth diſtance from your left-heel, and at the ſame time bring down your firelock as quick as poſſible to the reſt, ſinking it as far down before your left-hand as your right-hand will permit without conſtraint; your left hand being at the feather-ſpring, and your right, with fingers extended, held under the guard, taking care to draw in the muzzle well towards your body, and to dreſs in a line with the butt-end. 15. *Order your firelock*: i. e. Place your firelock nimbly with your left-hand againſt your right-ſhoulder; quit the firelock with the right-hand, ſinking it at the ſame time with your left; ſeize it at the muzzle, which muſt be of an equal height with your chin, and hold it cloſe againſt your right-ſide; lift up your right-foot, and place it by your left; at the ſame time throw back your left hand by your left-ſide, and with your right bring down the butt-end ſtrong upon the ground, placing it even with the toe of your right-foot; the thumb of your right-hand lying along the barrel, and the muzzle kept at a little diſtance from your body. 16. *Ground your firelock*: i. e. Half-face to the right upon your heels, and at the ſame time turn the firelock, ſo that the lock may point to the rear, and the flat of the butt-end lie againſt the inſide of your foot; at the ſame time ſliping the right-foot behind the butt of the firelock, the right-toe pointing to the right, and the left to the front: ſtep directly forward with your left-foot, about as far as the ſwell of the firelock, and lay it upon the ground, your left-hand hanging down by your left-leg, and your right kept faſt, with the butt-end againſt it; raiſe yourſelf up again nimbly, bringing back your left-foot to its former poſition, keeping your body faced to the right; face again to the left upon your heels, and come to your proper front, letting your hands hang down without motion. 17. *Take up your firelock*: i. e. Face to the right upon both heels; ſink your body down, and come to the poſition deſcribed in the ſecond motion of grounding; raiſe yourſelf and firelock, bringing it cloſe to your right ſide; come to your proper front, ſeizing your firelock at the muzzle, as in explanation 15. 18. *Reſt your firelock*: i. e. Bring your right-hand as far as the ſwell; raiſe the firelock high up in a perpendicular line from the ground with your right-hand, and ſeize it with your left above the ſpring, the cock being at the height of the waiſt-belt; ſtep back with your right-foot, placing it behind your left-heel, and come to the reſt. 19. *Shoulder your firelock*: i. e. Lift up your right-foot, and place it by your left; bring the firelock at the ſame time to your left-ſhoulder, and ſeize the butt-end with the left-hand, keeping it in the ſame poſition as above deſcribed; throw your right-hand briſkly back. 28. *Secure your firelock*: i. e. Bring the right-hand briſkly up, and place it under the cock, keeping the firelock ſteady in the ſame poſition; quit the butt with the left-hand, and ſeize the firelock with it at the ſwell, bringing the elbow cloſe down upon the lock; the right-hand being kept faſt in this motion, and the piece ſtill upright; quit the right-hand, and bring it down your right-ſide, bringing the firelock nimbly down to the ſecure; the left-hand in a line with the waiſt-belt. 21. *Shoulder your firelock*: i. e. Bring the firelock up to a perpendicular line, ſeizing it with the right-hand under the cock; quit the left-hand, and place it ſtrong upon the butt; quit the right hand, and bring it ſmartly down the right-ſide. 22. *Fix your bayonet*: i. e. Firſt and ſecond motions, as in the two firſt of the ſecure; quit the right-hand, and bring the firelock ſmartly down to the left-ſide with the left-hand, as far as it will admit without conſtraint, ſeizing the bayonet at the ſame time with the right-hand, and fixing it, placing that hand juſt below the braſs, with the piece kept cloſe to the hollow of the ſhoulder. 24. *Shoulder your firelock*: i. e. Quit the right-hand, and bring up the firelock with the left; ſeize it again under the cock with your right, as in the ſecond motion of the ſecure; quit the left-hand, and place it ſtrong upon the butt; quit the right-hand, and bring it down the right ſide. 24. *Preſent your arms*; i. e. as explained in three motions of the 14th word of command. 25. *To the right face*: i. e. Bring up the firelock with a quick motion high before you, till your left-hand comes even with your eyes, with the fingers of that hand extended along the ſtock, juſt above the feather-ſpring, the right-foot to be brought cloſe up to the left-heel in this motion; face to the right, taking care in facing to hold the firelock right up and down, and ſteady in your hands; ſtep back with your right-foot, and come down to your *preſent*, as in the foregoing explanation. 26. *To the right face*; i. e. as in the foregoing explanation, facing to the right. 27. *To the right-about face*; i. e. as in the 25th explanation, only coming to the right-about inſtead of to the right. 28. *To the left face*: i. e. Bring the right-foot briſkly to the hollow of your left, with the firelock in the ſame poſition as in the firſt motion of *facing to the right*; face to the left; come down to the *preſent*, as before. 29. *To the left face*; i. e. as in the foregoing explanation. 30. *To the left-about face*; i. e. as before, coming to the left-about inſtead of to the left. 31. *Shoulder your firelock*; i. e. as in the two motions of the 19th explanation. 32. *Charge your bayonet*; i. e. as in the firſt explanation: bring the ſwell of the firelock down ſtrong upon the palm of the hand, graſping the piece at the ſmall, behind the lock, and as high as the waiſt-belt; the firelock upon a level with the barrrel upwards. 33. *Shoulder your firelock*: i. e. Bring up the firelock to the ſhoulder, place the left-hand upon the butt, bringing the feet ſquare to the front; quit the right-hand, and throw it down on the right ſide. 34. *Advance your arms*; i. e. firſt and ſecond motions, as in the firſt explanation: bring the firelock down the right-ſide, with the right-hand as low as it will admit without conſtraint, ſlipping up the left-hand at the ſame time to the ſwell, the guard between the thumb and fore-finger of the right hand, the three laſt fingers under the cock, with the barrel to the rear; quit the left-hand. 35. *Shoulder your firelock*; i. e. bring up the left-hand, and ſeize it at the ſwell; come ſmartly up to the poiſe; ſhoulder. 36. *Prime and load*; i. e. come ſmartly to the *recover*, by ſpringing the firelock ſtraight up with the left-hand, turning the barrel inwards to the proper height of the recover: at the ſame time that the left-hand ſprings the firelock, the right hand is raiſed briſkly from the right-ſide, and ſeizes the firelock acroſs the breaſt: as it raiſes below the cock, the left-hand comes with a quick motion from the butt, and ſeizes the firelock ſtrong above the lock, the little finger of the left-hand at the ſpring of the lock, the left-hand at an equal height with the face, the butt cloſe to the body, but not preſſed, the firelock perpendicular oppoſite the left-ſide of the face: bring the firelock down with a briſk motion to the priming poſition, the left-hand holding the firelock, as in the priming; the thumb of the right-hand placed againſt the face of the ſteel, the fingers clinched, and the elbow turned a little out, that the wriſt may be clear of the cock: open the pan, by throwing up the ſteel with a ſtrong motion of the right arm, turning the elbow in, and keeping the firelock ſteady in the left-hand; handle your cartridge, prime, ſhut your pan, caſt about, load, draw rammers, ram down the cartridge, return the rammers, ſhoulder. N. B. The motion of recover, and coming down to the priming poſition and opening pans, are to be done in the uſual time. The motions of handling cartridge to ſhutting the pans, are to be done as quick as poſſible: when the pans are ſhut, a ſmall pauſe is to be made, and then caſt about together; then the loading motions are to be done as quick as poſſible; but before the rammer is returned, another ſmall pauſe is to be made, counting 1, 2, between each motion, till the firelock is ſhouldered.—*Front rank, make ready*; i. e. Spring the firelock briſkly to the *recover*, keeping the left foot faſt in this motion; as ſoon as the firelock is at the *recover*, without any ſtop, ſink the body briſkly without ſtooping forward, with a quick motion down upon the right-knee; the butt-end of the firelock at the ſame time falls upon the ground, the front part of the butt being in a line with the heel of the left-foot. As ſoon as the butt comes to the ground, the firelock is to be cocked, immediately ſeizing the cock and ſteel in the right-hand; the firelock to be held firm in the left-hand, about the middle of that part of the firelock between the lock and the ſwell of the ſtock; the point of the left-thumb to be cloſe to the ſwell, pointing upwards. As the body is ſinking, the right knee is to be thrown as far back as the left-leg may be right up and down; the right foot to be thrown a little to the right; the body to be kept ſtraight; the head up, looking to the right along the rank, the ſame as if ſhouldered; the firelock to be upright, and the butt about four inches to the right of the inſide of the left-foot. *Preſent*; i. e. Bring the firelock briſkly down to the *preſent*, by extending the left-arm to the full length with a ſtrong motion; at the ſame time ſpring up the butt by the cock with the right-hand, and raiſe the butt ſo high upon the right-ſhoulder, that you may not be obliged to ſtoop too much with the head; the right-cheek to be cloſe to the butt, and the left-eye ſhut, and look along the barrel with the right-eye from the breech-pin to the muzzle; keep the left-elbow down in an eaſy poſition, and ſtand as ſteady as poſſible; the thumb of the right hand to remain in the poſition as deſcribed in the third explanation of the manual. *Fire*; i. e. Pull the trigger as directed in the manual; and as ſoon as the piece is fired, give yourſelf a ſtrong ſpring upon your left-leg; raiſing your body briſkly, and ſtraight up, keeping your left-foot faſt, and bringing the right-heel to the inſide of the left; at the ſame time the firelock is to be brought up to the priming poſition, and half-cocked immediately: a ſhort pauſe is to be made; then handle cartridge, and go on with the loading motions deſcribed in the explanation of *prime and load*.—*Centre rank make ready*: i. e. Spring the firelock briſkly to the recover; ſo ſoon as the left-hand ſeizes the firelock above the lock, the right elbow is to be nimbly raiſed a little, placing the thumb of that hand upon the cock; the fingers open by the plate of the lock, and as quick as poſſible force the piece to the cock, by dropping the elbow, and forcing down the cock with the thumb, ſtepping at the ſame time a moderate pace to the right, keeping the left foot faſt; as the firelock is cocked, the thumb is to fall below the cock, the right hand ſeizing the firelock cloſe under the cock firmly, the fore-finger not to be before the trigger; the piece to be held in this poſition perpendicular, oppoſite the left-ſide of the face, the butt cloſe to the left-breaſt, but not preſſed; the body to be ſtraight, and as full to the front as poſſible; the head kept up, looking to the right of the rank, that the body and the firelock may not ſtoop forward, nor lean much out of the rank. *Preſent*: i. e. Spring the firelock from the body to the arm's length with a quick motion, preſſing down the muzzle with the left-hand, and ſpring up the butt with the right-hand, as in the foregoing explanation of the *front rank. Fire*. As in explanation 4, in the manual, with this difference, that the left-foot is to be brought up to the right, at the ſame time that the firelock is brought down to the priming poſition. The loading motions as in the explanations of priming and loading; and at the laſt motion of ſhouldering, to ſpring to the left again, and cover the file-leaders.—*Rear rank, make ready*; i. e. Recover the firelock, and cock as before directed for the centre-rank; as the firelock is recovered and cocked, ſtep briſkly ſtraight to the right, with the right-foot,

foot, a full pace; bring the left-heel about ſix inches before the right-foot; the body ſtraight, and as ſquare to the front as poſſible, as in the explanation of the *centre rank*. *Preſent:* As in explanation *preſent*, before. *Fire:* As in explanation of the *centre rank;* and as the firelock is coming down to the priming poſition, the left is to be brought back to the right; and at the laſt motion of ſhouldering, to ſpring to the left again, and cover the file-leader.

There are ſome peculiar words of command at the manual exerciſe of the granadiers, when apart from the battalion; and alſo for the cavalry and artillery.

MANUDUCTOR, a name given to an ancient officer in the church; who, from the middle of the choir, where he was placed, gave the ſignal for the choiriſters to ſing, and marked the meaſure, beat time, and regulated the muſic. The Greeks called him *meſochoros*, becauſe ſeated in the middle of the choir; but in the Latin church he was called *manuductor;* from *manus* and *duco*, "I lead;" becauſe he led and guided the choir by the motions and geſture of the hand.

MANUFACTURE, a commodity produced from raw or natural materials, either by the work of the hand or by machinery.

MANUFACTURER, one who works up a natural product into an artificial commodity.

MANUMISSION, an act whereby a ſlave or villain is ſet at liberty, or let out of bondage. The word comes from the Latin *manus*, "hand;" and *mittere*, "to ſend;" *quia ſervus mittebatur extra manum ſeu poteſtatem domini ſui.* Some authors define manumiſſion an act by which a lord enfranchiſes his tenants, who till that time had been his vaſſals, and in a ſtate of ſlavery inconſiſtent with the ſanctity of the Chriſtian faith.

Among the Romans, the manumiſſion of ſlaves was performed three ſeveral ways. 1. When, with his maſter's conſent, a ſlave had his name entered in the cenſus or public regiſter of the citizens. 2. When the ſlave was led before the prætor, and that magiſtrate laid his wand called *vindicta* on his head. 3. When the maſter gave the ſlave his freedom by his teſtament. Servius Tullus is ſaid to have ſet on foot the firſt manner; and P. Valerius Publicola the ſecond. A particular account is given of the third in the Inſtitutes of Juſtinian. It was not neceſſary that the prætor ſhould be on his tribunal to perform the ceremony of manumiſſion: he did it any where indifferently, in his houſe, in the ſtreet, in going to bathe, &c. He laid the rod on the ſlave's head, pronouncing theſe words, *Dico eum liberum eſſe more Quiritum;* "I declare him a freeman, after the manner of the Romans." This done, he gave the rod to the lictor, who ſtruck the ſlave with it on the head, and afterwards with his hand on his face and back; and the notary or ſcribe entered the name of the new-freed man in the regiſter, with the reaſons of his manumiſſion. The ſlave had likewiſe his head ſhaved, and a cup given him by his maſter as a token of freedom. Tertullian adds, that he had then alſo a third name given him: if this were ſo, three names were not a token of nobility, but of freedom. The emperor Conſtantine ordered the manumiſſions at Rome to be performed in the churches.

Of manumiſſion there have alſo been various forms in England. In the time of the Conqueror, villains were manumitted, by the maſter's delivering them by the right hand to the viſcount, in full court, ſhowing them the door, giving them a lance and a ſword, and proclaiming them free. Others were manumitted by charter. There was alſo an implicit manumiſſion; as when the lord made an obligation for payment of money to the bondman at a certain day, or ſued him where he might enter without ſuit, and the like.

MANURE, any thing uſed for fattening and improving land. See Agriculture, Part I. Sect. I. II. and III.

MANUSCRIPT, a book or paper *written with the hand;* by which it ſtands oppoſed to a *printed* book or paper. A manuſcript is uſually denoted by the two letters MS. and in the plural by MSS. What makes public libraries valuable is the number of ancient manuſcripts repoſited in them; ſee Alexandrian, Cambridge, Clermont, Cottonian, Harleian, Vatican, &c.

MANUTIUS (Aldus), the firſt of thoſe celebrated Venetian printers who were as illuſtrious for their learning as for uncommon ſkill in their profeſſion. He was born at Baſſano in Italy about the middle of the 15th century; and hence is ſometimes called *Baſſianus*, though generally better known by the name of *Aldus*. He was the firſt who printed Greek neatly and correctly; and acquired ſo much reputation by it, that whatever was finely printed was proverbially ſaid to have "come from the preſs of Aldus." We have a kind of Greek grammar of his; with Notes upon Homer, Horace, &c. He died at Venice, where he exerciſed his profeſſion, in 1516.

Manutius (Paulus), ſon of the former, was brought up to his father's profeſſion. He was more learned than him; and he acquired, by continual reading of Tully, ſuch a purity in writing Latin, that even Scaliger allows a Roman could not exceed. Pope Pius IV. placed him at the head of the apoſtolical preſs, and gave him the charge of the Vatican library. His Epiſtles are infinitely laboured, and very correct; but, as may be ſaid of moſt of the Ciceronians, they contain ſcarcely any thing but mere words. This conſtant reading of Tully, however, together with his profound knowledge of antiquity, qualified him extremely well for an editor of Tully; whoſe works he accordingly publiſhed, with Commentaries on them, in 4 vols folio, at Venice in 1523. He died in 1574.

Manutius (Aldus), the Younger, the ſon of Paulus, and the grandſon of Aldus, was eſteemed one of the greateſt geniuſes and moſt learned men of his time, Clement VIII. gave him the direction of the Vatican printing-houſe; but probably the profits of that place were very ſmall, ſince Manutius was obliged, for his ſubſiſtence, to accept of a profeſſor of rhetoric's chair, and to ſell the excellent library that was in his family, which his father, his uncle, and his great-uncle, had collected with extraordinary care, and which it is ſaid contained 80,000 volumes. He died at Rome in 1597, without any other recompenſe than the praiſes due to his merit. He wrote, 1. Commentaries on Cicero. 2. A treatiſe on orthography. 3. Three books of epiſtles; and other works in Latin and Italian, which are eſteemed.

MAON (anc. geog.) a town of the tribe of Judah, to the ſouth-eaſt, towards the Dead Sea. It gave name to the *wilderneſs of Maon*, 1 Sam. xxii.

MAP, a plain figure, repreſenting the ſurface of the earth, or a part thereof, according to the laws of perſpective. See GEOGRAPHY, n° 63—73.

MAPLE. See ACER.

Maple-Sugar. See SUGAR.

MAPLETOFT (Dr John), deſcended from a good family in Huntingdonſhire, was born in 1631. He was educated in Trinity-college, Cambridge, and qualified himſelf for the profeſſion of phyſic; and in 1675 was choſen profeſſor of that art at Greſham college. He tranſlated Dr Sydenham's *Obſervationes Medicæ circa morborum acutorum hiſtoriam et curationem* into the Latin, and Sydenham dedicated them to Mapletoft. He married in 1679, and ſoon after transferred his ſtudies from phyſic to divinity; took orders; obtained the vicarage of St Laurence Jewry, with the lectureſhip of St Chriſtopher's in London; and having been a benefactor to Sion college, was, in 1707, elected preſident. He continued to preach in his church of St Laurence Jewry till he was above 80 years of age; and in his decline printed a book intitled *The principles and duties of the Chriſtian religion*, &c. 8vo. 1710, a copy of which he ſent to every houſe in his pariſh. He was a polite ſcholar; and beſides ſome other pieces on moral and theological ſubjects, there are in the Appendix to Ward's Lives of the profeſſors of Greſham-college, three Latin lectures read there by him, on the origin of the art of medicine, and the hiſtory of its invention.

MAPPA, in the public games of the Roman circus, was a napkin hung out at the prætor's or other great magiſtrate's ſeat, as a ſignal for the race or other diverſions to begin. The mappa was received by the mapparius, or perſon who held it, from the conſul, prætor, or other great officer. Notice was anciently given by ſound of trumpet; but Nero is ſaid to have introduced the mappa, by throwing his napkin out of the window to ſatiſfy the people, who grew noiſy at the delay of the ſports while he was at dinner.

MAPPARIUS, in Roman antiquity, the officer who gave the ſignal to the gladiators to begin fighting; which he did by throwing an handkerchief that he had received from the emperor or other magiſtrate.

MARACANDA (anc. geog.), capital of the Sogdiana. Now thought to be *Samarcand*, a city of Uſbec Tartary in Aſia, the country and royal reſidence of Tamerlane. See SAMARCAND.

MARACAYBO, a rich and conſiderable town of South America, and capital of the province of Venezuela, ſeated near a lake of the ſame name. It carries on a great trade in ſkins and chocolate, which is the beſt in America; and they have likewiſe very fine tobacco. It was taken by the French bucaneers in 1666 and 1678. W. Long. 70. 45. N. Lat. 10. 0.

MARACAYBO, a lake in South America, 200 miles long and 100 broad, which diſcharges itſelf by a river into the North Sea. It is well defended by ſtrong forts; which, however, did not hinder Sir Henry Morgan, a bucaneer, from entering it, and plundering ſeveral Spaniſh towns on the coaſt, after defeating a ſquadron ſent out againſt him.

MARAGNAN, a province of Brazil in South America, which comprehends a fertile populous iſland, 112 miles in circumference. The French ſettled here in 1612, and built a town; but they were ſoon driven from thence by the Portugueſe, who have poſſeſſed it ever ſince. The town is little, but ſtrong; and has a caſtle, a harbour, and a biſhop's ſee. The climate is very agreeable and wholeſome, and the ſoil produces plenty of all the neceſſaries of life. W. Long 54. 35. S. Lat. Lat. 2. 0.

MARALDI (James Philip), a learned mathematician and aſtronomer, of the academy of ſciences at Paris, was born in 1665. He was the ſon of Francis Maraldi and Angela Catharine Caſini, the ſiſter of the famous aſtronomer of that name. His uncle made him go to France in 1687, where he acquired great reputation on account of his learning and obſervations. He made a catalogue of the fixed ſtars, which is more particular and exact than Bayer's; and has given a great number of curious and intereſting obſervations in the memoirs of the academy; in particular, thoſe on bees and petrifactions have been univerſally applauded. He died in 1729.

MARANA (John Paul), an ingenious writer of the 17th century, was of a diſtinguiſhed family, and born at Genoa; where he received an education ſuitable to his birth, and made a great progreſs in the ſtudy of polite literature and the ſciences. Having been engaged in the conſpiracy of Raphael della Terra, to deliver up Genoa to the duke of Savoy, he was in 1670, when 28 years of age, impriſoned in the tower of that city, and remained there four years. Being at length ſet at liberty, he was ordered to write the hiſtory of that conſpiracy; but, when finiſhed, it was ſeized and prevented from being publiſhed. When the republic of Genoa was at variance with the court of France, Marana, who had always an inclination for that court, was afraid of being impriſoned a ſecond time; and retired to Monaco, where he again wrote the hiſtory of the conſpiracy in Italian; and, in 1682; went to Lyons to get it printed. From Lyons he went to Paris, where his merit ſoon acquired him powerful protectors. He ſpent the reſt of his life in a happy and tranquil mediocrity, devoted to ſtudy and the ſociety of men of learning; and died in 1693. His hiſtory of the conſpiracy contains many curious and intereſting anecdotes, which are nowhere elſe to be found. He alſo wrote ſeveral other works; the moſt known of which is the Turkiſh Spy, in 6 vols 12mo, which was in 1742 augmented to ſeven. Of this ingenious work we have an excellent Engliſh tranſlation.

MARANO, a town of Italy, in the territory of Venice and province of Friuli, with a ſtrong citadel; ſeated in a marſh at the bottom of the Gulph of Venice, which renders it difficult of acceſs.

MARANS, a rich town of France, in the territory of Aunis and dioceſe of Rochelle, ſeated among ſalt marches, near the river Sevre, three miles from the ſea. It carries on a very great trade in corn; and is ſeated in W. Long. 0. 55. N. Lat. 46. 20.

MARANTA, INDIAN ARROW-ROOT: A genius of the monogynia order, belonging to the monandria claſs of plants; and in the natural method ranking under the eighth order, *Scitamineæ*. The corolla is ringent and quinquefid, with two ſegments alternately patent. There are three ſpecies, the arundinacea, galango, and comoſa, all of them herbaceous perennial exotics of the Indies, kept here in hot-houſes for curioſity: they have thick, knotty, creeping roots, crowned with long, broad, arundinaceous leaves, ending in points, and upright ſtalks, half a yard high, terminated by bunches of monopetalous, ringent, five-parted flowers. They are propagated by parting the roots in ſpring, and planting them in pots of light rich earth, and then plunging them in the bark-bed. The root of the galanga is uſed by the Indians to extract the virus communicated by their poiſoned arrows; from whence it has derived its name of *arrow root*. The arundinacea, or ſtarch plant, riſes to two feet, has broad pointed leaves, ſmall white flowers, and one ſeed. It is cultivated in gardens and in proviſion-grounds in the Weſt Indies; and the ſtarch is obtained from it by the following proceſs deſcribed by Dr Wright. "The roots when a year old are dug up, well waſhed in water, and then beaten in large deep wooden mortars to a pulp. This is thrown into a large tub of clean water. The whole is then well ſtirred, and the fibrous part wrung out by the hands, and thrown away. The milky liquor being paſſed through a hair ſieve, or coarſe cloth, is ſuffered to ſettle, and the clear water is drained off. At the bottom of the veſſel is a white maſs, which is again mixed with clean water and drained: laſtly, the maſs is dried on ſheets in the ſun, and is pure ſtarch."—A decoction of the freſh roots (the Doctor informs us) makes an excellent ptiſan in acute diſeaſes.

MARASMUS, among phyſicians, denotes an atrophy or conſumption in its laſt and moſt deplorable ſtage.

MARATHON (anc. geog.), one of the demi or hamlets of Attica; about 10 miles to the north-eaſt of Athens, towards Bœotia, near the ſea. It ſtill retains its ancient name (Dr Chandler informs us); but is very inconſiderable, conſiſting only of a few houſes and gardens. The plain of Marathon, famous for Miltiades's victory over the Perſians, by which the liberties of Athens and other cities of Greece were ſaved, is long and narrow, but conſiſting chiefly of level ground, and therefore admitting the operations of cavalry, which formed the main ſtrength of the barbarian army, and with which the Greeks were very poorly provided. Here the Perſians, under the command of Datis, pitched their camp, by the advice of Hippias the baniſhed king of Athens, whoſe ſolicitations and intrigues had promoted the expedition, and whoſe perfect knowledge of the country, and intimate acquaintance with the affairs of Greece, rendered his opinion on all occaſions reſpectable. The Perſian army is ſaid to have conſiſted of 100,000 infantry, and 10,000 horſe.—Athens was in the utmoſt conſternation and diſmay. She had, upon the firſt appearance of the Perſian fleet, ſent to implore aſſiſtance from the other nations of Greece; but ſome had ſubmitted to Darius, and others trembled at the very name of the Medes or Perſians. The Lacedæmonians alone promiſed troops; but various obſtacles did not allow them immediately to form a junction with thoſe of Athens. This city therefore could only rely on its own ſtrength; and happily at this moment there appeared three men deſtined to give new energy to the ſtate. Theſe were Miltiades, Ariſtides, and Themiſtocles whoſe example and harangues kindled the flame of the nobleſt heroiſm in the minds of the Athenians. Levies were immediately made. Each of the ten tribes furniſhed 1000 foot ſoldiers with a commander at their head. To complete this number it was neceſſary to enrol the ſlaves (A.) No ſooner were the troops aſſembled than they marched out of the city into the plain of Marathon, where the inhabitants of Platæa in Bœotia ſent them a reinforcement of 1000 infantry.

Scarcely were the two armies in ſight of each other, before Miltiades propoſed to attack the enemy. Ariſtides and ſeveral of the commanders warmly ſupported this meaſure: but the reſt, terrified at the exceſſive diſproportion of the armies, were deſirous of waiting for the ſuccours from Lacedæmon. Opinions being divided, they had recourſe to that of the polemarch, or chief of the militia, who was conſulted on ſuch occaſions, to put an end to the equality of ſuffrages. Miltiades addreſſed himſelf to him, with the ardour of a man deeply impreſſed with the importance of preſent circumſtances: "Athens (ſaid he to him) is on the point of experiencing the greateſt of viciſſitudes. Ready to become the firſt power of Greece, or the theatre of the tyranny and fury of Hippias, from you alone, Callimachus, ſhe now awaits her deſtiny. If we ſuffer the ardour of the troops to cool, they will ſhamefully bow beneath the Perſian yoke; but if we lead them on to battle, the gods and victory will favour us. A word from your mouth muſt now precipitate your country into ſlavery or preſerve her liberty." Callimachus gave his ſuffrage, and the battle was reſolved. To enſure ſucceſs, Ariſtides, and the other generals after his example, yielded to Miltiades the honour of the command which belonged to them in rotation: but, to ſecure them from every hazard, he preferred waiting for the day which of right placed him at the head of the army.

When that day arrived, Miltiades drew up his troops at the foot of a mountain, on a ſpot of ground ſcattered over with trees to impede the Perſian cavalry. The Platæans were placed on the left wing; Callimachus commanded the right; Ariſtides and Themiſtocles were in the centre of the battle, and Miltiades every where. An interval of nearly a mile ſeparated the Grecian army from that of the Perſians. At the firſt ſignal the Greeks advanced over this ſpace running. The Perſians, aſtoniſhed at a mode of attack ſo novel to both nations, for a moment remained motionleſs; but to the impetuous fury of the enemy they ſoon oppoſed a more ſedate and not leſs formidable fury. After an obſtinate conflict of ſome hours, victory began to declare herſelf in the two wings of

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(A) *Travels of Anacharſis*; authority, *Pauſan.* i. 79. But Dr Gillies ſeems to think that the armed ſlaves were not included in the 10,000; but amounted of themſelves to a greater number, and which formed the centre of the battle.

Marathon.

the Grecian army. The right diſperſed the enemy in the plain, while the left drove them back on a moraſs that had the appearance of a meadow, in which they ſtuck faſt and were loſt. Both theſe bodies of troops now flew to the ſuccour of Ariſtides and Themiſtocles, ready to give way before the flower of the Perſian troops placed by Datis in the centre of the battle. From this moment the rout became general. The Perſians, repulſed on all ſides, found their only aſylum in the fleet which had approached the ſhore. The conquerors purſued them with fire and ſword, and took, burnt or ſunk the greater part of their veſſels: the reſt eſcaped by dint of rowing.

The Perſian army loſt about 6400 men; that of the Athenians 192. Miltiades was wounded; Hippias was left dead on the field, as were Steſileus and Callimachus, two of the Athenian generals. Scarcely was the battle over, when a ſoldier worn out with fatigue forms the project of carrying the firſt news of ſo ſignal a ſucceſs to the magiſtrates of Athens, and without quitting his arms, he runs, flies, arrives, announces the victory, and falls dead at their feet.

This battle was fought on the 6th of Boedromion, in the third year of the 72 Olympiad (or 29th September anno 490 B. C.). The next day 2000 Spartans arrived. In three days and nights they had marched 1200 ſtadia. Though informed of the defeat of the Perſians, they continued their march to Marathon, nor did they enviouſly ſhun to behold thoſe fields where a rival nation had ſignalized itſelf by ſo heroic an action: they there beheld the tents of the Perſians ſtill ſtanding, the plain ſtrewed over with dead, and covered with coſtly ſpoils: they there found Ariſtides, who with his tribe was guarding the priſoners and booty; and did not retire until they had beſtowed juſt applauſes on the victors.

The Athenians neglected nothing to eterniſe the memory of thoſe who fell in the battle. It had been uſual to inter the citizens who periſhed in war, at the public expence, in the Ceramicus without the city; but the death of theſe was deemed uncommonly meritorious. They were buried, and a barrow was made for them, where their bravery had been manifeſted. Their names were engraven on half columns erected on the plain of Marathon. Theſe monuments, not excepting thoſe of the generals Callimachus and Steſileus, were in a ſtyle of the greateſt ſimplicity. In the intervals between them were erected trophies bearing the arms of the Perſians. An artiſt of eminence had painted all the circumſtances of the battle in one of the moſt frequented porticoes of the city: Miltiades was there repreſented at the head of the generals, and in the act of exhorting the troops to fight for their country.

Pauſanias examined the field of battle about 600 years after this event His account of it is as follows. "The barrow of the Athenians is in the plain, and on it are pillars containing the names of the dead under thoſe of the tribes to which they belonged; and there is another for the Platæenſians and ſlaves; and a diſtinct monument of Miltiades the commander, who ſurvived this exploit. There may be perceived nightly the neighing of horſes and the claſhing of arms. No perſon has derived any good from waiting on purpoſe to behold the ſpectres; but their anger does not fall on any one who happens to ſee them without deſign. The Marathonians worſhip thoſe who were ſlain in the battle, ſtyling them *heroes*.—A trophy alſo of white marble has been erected. The Athenians ſay the Medes were buried, religion requiring that the corpſe of a man be covered with earth; though I was not able to find any place of ſepulture; for there is no barrow or other ſign viſible, but they threw them promiſcuouſly into a pit.—Above the lake are the marble mangers of the horſes of Artaphernes, with marks of a tent on the rocks."

Maratta, Maratti.

Many centuries have elapſed ſince the age of Pauſanias; but the principal barrow, it is likely that of the gallant Athenians, ſtill towers above the level of the plain. It is of light fine earth, and has a buſh or two growing on it. Dr Chandler informs us that he enjoyed a pleaſing and ſatisfactory view from the ſummit; and he looked, but in vain, for the pillars on which the names were recorded, lamenting that ſuch memorials ſhould ever be removed. At a ſmall diſtance northward is a ſquare baſement of white marble, perhaps part of the trophy. A Greek church has ſtood near it; and ſome ſtones and rubbiſh, diſpoſed ſo as to form an open place of worſhip, remain.

MARATTA. See MARHATTAS.

MARATTI (Carlo), a celebrated painter, was born at Camorano, near Ancona, in 1625. He came a poor boy to Rome, when only 11 years old; and at 12 recommended himſelf ſo effectually to Andrea Sacchi, by his drawings after Raphael in the Vatican, that he took him into his ſchool, where he continued 25 years till his maſter's death. His graceful and beautiful ideas occaſioned his being generally employed in painting madonas and female ſaints. No man ever performed in a better ſtyle, or with a greater elegance. From the fineſt ſtatues and pictures, he made himſelf maſter of the moſt perfect forms, and the moſt charming airs of heads, which he ſketched with equal eaſe and grace. He has produced a noble variety of draperies, more artfully managed, more richly ornamented, and with greater propriety than even the beſt of the moderns. He was inimitable in adorning the head, in the diſpoſal of the hair, and the elegance of his hands and feet, which are equal to thoſe of Raphael; and he particularly excelled in gracefulneſs. In his younger days he etched a few prints, as well of his own invention as after others, with equal ſpirit and correctneſs. It would be endleſs to recount the celebrated paintings done by this great man. Yet he executed nothing ſlightly, often changed his deſign, and almoſt always for the better, whence his pictures were long in hand. By the example of his maſter, he made ſeveral admirable portraits of popes, cardinals, and other people of diſtinction, from whom he received the higheſt teſtimonies of eſteem, as he likewiſe did from almoſt all the monarchs and princes of Europe. Innocent XI. appointed him keeper of the paintings in his chapel and the Vatican. Maratti erected two noble monuments for Raphael and Hannibal, at his own expence, in the Pantheon. How well he maintained the dignity of his profeſſion, appears by his anſwer to a Roman prince, who complaining of the exceſſive price of his pictures, he told him there was a vaſt debt due from the world to the famous artiſts his predeceſſors, and that he, as their rightful ſucceſſor, was come to claim thoſe arrears. His abilities in painting were accompanied with many virtues, and particularly with an extenſive charity. This great painter died at Rome in 1713, in the 88th year of his age.

MARAUDING, in a military ſenſe, means a party of ſoldiers, who, without any order, go into the neighbouring houſes and villages, when the army is either in camp or garriſon, to plunder and deſtroy, &c. Marauders are a diſgrace to the camp, to the military profeſſion, and deſerve no better quarter from their officers than they give to poor peaſants, &c.

MARAVEDI, a little Spaniſh copper coin, worth ſomewhat more than a French denier, or half a farthing Engliſh.

The Spaniards always count by maravedis, both in commerce and in their finances, though the coin itſelf is no longer current among them. Sixty-three maravedis are equivalent to a rial of ſilver; ſo that the piaſter, or piece of eight rials, contains 504; and the piſtole of four pieces of eight, 2016 maravedis.

This ſmallneſs of the coin produces vaſt numbers in the Spaniſh accounts and calculation; inſomuch that a ſtranger or correſpondent would think himſelf indebted ſeveral millions for a commodity that coſt but a few pounds.

In the laws of Spain, we meet with ſeveral kinds of maravedis; Alphonſine maravedis, white maravedis, maravedis of good money, maravedis Combrenos, black maravedis, and old maravedis. When we find maravedis alone, and without any addition, it is to be underſtood of thoſe mentioned above. The reſt are different in value, fineneſs of metal, time, &c. Mariana aſſerts, that this coin is older than the Moors; that it came from the Goths; that it was anciently equal to a third part of the rial, and conſequently of 12 times the value of the preſent maravedi. Under Alphonſus XI. the maravedi was 17 times, under Henry II. ten times, under Henry III. five times, and under John II. two times and an half, the value of the preſent maravedi.

MARBELLA, a town of Andaluſia in Spain, ſituated at the mouth of the Rio Verde, 30 miles north-eaſt of Gibraltar, and 28 ſouth-weſt of Malaga. W. Long. 5. 25. N. Lat. 30. 25.

MARBLE, in natural hiſtory, a genus of foſſils; being bright and beautiful ſtones compoſed of ſmall ſeparate concretions, moderately hard, not giving fire with ſteel, fermeting with and ſoluble in acid menſtrua, and calcining in a ſlight fire.— The word comes from the French *marbre*, and that from the Latin *marmor*, of the Greek μαρμαιρειν to "ſhine or glitter.

The colours by which marbles are diſtinguiſhed are almoſt innumerable; but the moſt remarkable are, 1. The black marble of Flanders. 2. Plain yellow. 3. Yellow with ſome white veins. 4. Yellow with black dendrites. 5. Yellow with brown figures reſembling ruins. 6. Black and yellow. 7. Black and white. 8. Pale yellow, with ſpots of a blackiſh grey colour. 9. Yellow, white, and red. 10. Pale yellow. 11. Olive colour, with deeper coloured croſs lines, and dendrites. 12. Browniſh red. 13. Fleſh-coloured and yellow. 14. Common red marble. 15. Crimſon, white, and grey. 16. Reddiſh-brown lumps, on a whitiſh ground. 17. Bluiſh-grey. 18. Snowy-white.

The varieties of marble, numerous as they are, have been improperly augmented by virtuoſos, and ſome people who collect ſpecimens for the ſake of gain. The Italians are particularly curious in this way; and moſt of the names impoſed upon marbles are given by them. Every marble brought from an unknown place is called by them *antico;* when diſtinguiſhed by a number of bright colours, it is called *brocatello* or *brocatellato*. When they want ſome of the originals to complete a whole ſet of marbles, they either ſubſtitute others which have the neareſt reſemblance to them; or, laſtly, they ſtain white marbles according to their own fancy, and impoſe them on the world as natural. The fineſt ſolid modern marbles are thoſe of Italy, Blankenburg, France, and Flanders. It has alſo been lately diſcovered, that very fine marble is contained in ſome of the Weſtern iſlands of Scotland. Thoſe of Germany, Norway, and Sweden, are of an inferior kind, being mixed with a kind of ſcaly limeſtone; and even ſeveral of thoſe abovementioned are partly mixed with this ſubſtance, though in an inferior degree. Cronſtedt, however, mentions a new quarry of white marble in Sweden, which, from the ſpecimens he had ſeen, promiſed to be excellent.

The ſpecific gravity of marble is from 2700 to 2800; that of Carriera, a very fine Italian marble, is 2717.—Black marble owes its colour to a ſlight mixture of iron. Mr Bayen found ſome which contained 5 *per cent* of the metal: notwithſtanding which, the lime prepared from it was white, but in time it acquired an ochry or reddiſh-yellow colour.

Marble, when chemically examined, appears to conſiſt of calcareous earth united with much fixed air; and is like limeſtone or chalk, capable of being converted into a ſtrong quicklime.—Dr Black derives the origin of marbles, as well as limeſtone and marle, from the ſame ſource, *viz.* from the calcareous matter of ſhells and lithophyta. In one kind of limeſtone known by the name of *Portland-ſtone*, and conſiſting of round grains united together, it was ſuppoſed to be compoſed of the ſpawn of fiſh; but compariſons of other phenomena have explained it. It is plain that it has been produced from a calcareous ſand, which is found on the ſhore of ſome of the iſlands in the ſouthern climates, By the conſtant agitation the ſofter parts are worn off, and the harder parts remain in the form of particles that are highly poliſhed, and which are afterwards gradually made to concrete together by cauſes of which we have yet no knowledge.—There are indeed ſome few of the limeſtones and marbles in which we cannot diſcover any of the relics of the ſhells; but there are many ſigns of their having been in a diſſolved or liquified ſtate; ſo we cannot expect to ſee the remains of the form of the ſhells; but even in many of the marbles that have the greateſt appearance of a complete mixture, we ſtill find often the confuſed remains of the ſhells of which they have been originally compoſed. We ſhould ſtill find it difficult to conceive how ſuch maſſes ſhould have derived their origin from ſhells; but, conſidering the many collections that we have an opportunity of ſeeing in their ſteps towards this proceſs, and a little concreted together, ſo that by their going a ſtep farther they might form limeſtone and marbles, we ſhall ſoon ſee the poſſibility of their being all produced in the ſame manner. Thus vaſt quantities of ſhells have been found in the province of Turin in France: and indeed there is no place where they have not been found. The lithophyta likewiſe ſeem to be a very fruitful ſource of this kind of earth. In the cold climates, where the moderate degree of heat is not ſo productive of animal-life, we have not ſuch an opportunity of obſerving this; but in the hot climates, the ſea, as well as the land, ſwarms with innumerable animals; and, at the bottom, with thoſe that produce the corals and madripores. We learn from the hiſtory of a ſhip that was ſunk in a ſtorm in the Gulf of Mexico, the vaſt growth there is of thoſe bodies. About 20 years after, they attempted to dive into it to get out a quantity of ſilver: but they found great difficulty in getting it, from the ſhip being overgrown with coral. Sir Hans Sloan, in the Philoſophical Tranſactions, and in his hiſtory of Jamaica, obſerves, that the ſhip's timber, the iron, and money, were all concreted by the growth of the calcareous matter. So in a tract of many thouſands of years the quantity of it ſhould be very great; and as this is going on through a very great extent of the bottom of the ſea, it will produce very extenſive as well as maſſy collections of calcareous matter.

According to Sir William Hamilton †, many variegated marbles and prenious ſtones are the produce of volcanoes.

Artificial MARBLES. The ſtucco, whereof they make ſtatues, buſts, baſſo-relievos, and other ornaments of architecture, ought to be marble pulverized, mixed in a certain proportion with plaſter; the whole well ſifted, worked up with water, and uſed like common plaſter. See STUCCO.

There is alſo a kind of artificial marble made of the flaky ſeleaites, or a tranſparent ſtone reſembling plaſter; which becomes very hard, receives a tolerable poliſh, and may deceive a good eye. This kind of ſelenites reſembles Muſcovy talc.

There is another ſort of artificial marble formed by corroſive tinctures, which, penetrating into white marble to the depth of a line or more, imitate the various colours of other dearer marbles.

There is alſo a preparation of brimſtone in imitation of marble.

To do this, you muſt provide yourſelf with a flat and ſmooth piece of marble; on this make a border or wall, to encompaſs either a ſquare or oval table, which may be done either with wax or clay. Then having ſeveral ſorts of colours, as white lead, vermilion, lake, orpiment, maſticot, ſmalt, Pruſſian blue &c. melt on a ſlow fire ſome brimſtone in ſeveral glazed pipkins; put one particular ſort of colour into each, and ſtir it well together; then having before oiled the marble all over within the wall, with one colour quickly drop ſpots upon it of larger and leſs ſize: after this, take another colour and do as before, and ſo on till the ſtone is covered with ſpots of all the colours you deſign to uſe. When this is done, you are next to conſider what colour the maſs or ground of your table is to be; if of a grey colour, then take fine ſifted aſhes, and mix it up with melted brimſtone; or if red, with Engliſh red ochre; if white, with white-lead; if black, with lamp or ivory black. Your brimſtone for the ground muſt be pretty hot, that the coloured drops on the ſtone may unite and incorporate with it. When the ground is poured even all over, you are next, if judged neceſſary, to put a thin wainſcot board upon it: this muſt be done whilſt the brimſtone is hot, making alſo the board hot, which ought to be thoroughly dry, in order to cauſe the brimſtone to ſtick the better to it. When the whole is cold, take it up, and poliſh it with a cloth and oil, and it will look very beautiful.

Elaſtic MARBLE, an extraordinary ſpecies of foſſil which has ſurpriſed all the naturaliſts who have ſeen it. There are ſeveral tables of it preſerved in the houſe of Prince Borgheſe at Rome, and ſhown to the curious. F. Jacquer a celebrated mathematician, has given a deſcription in the Literary Gazette of Paris, but the naturaliſts cannot be contented with it. If permiſſion was given to make the requiſite experiments, this curious phenomenon might be beter illuſtrated. There are five or ſix tables of that marble; their length is about two feet and a half, the breadth about ten inches, and the thickneſs a little leſs than three. They were dug up, as the Abbe Fortis was told, in the feod of Mondragone; the grain is of Carrareſe marble, or perhaps of the fineſt Greek. They ſeem to have ſuffered ſome attack of fire; though the firſt degree of pulverization obſervable in the angles, can, perhaps, ſcarcely be called that of imperfect calcination. They are very dry, do not yield to external impreſſion, reſound to the hammer, like other congenerous marble, and are perhaps ſuſceptible of a poliſh. Being ſet on end, they bend, oſcillating backward and forward; when laid horizontally, and raiſed at one end, they form a curve, beginning towards the middle; if placed on a table, and a piece of wood or any thing elſe is laid under them they make a ſalient curve and touch the table with both ends. Notwithſtanding this flexibility, they are liable to be broken if indiſcreetly handled; and therefore one table only, and that not the beſt, is ſhown to the curious. Formerly they were all together in the prince's apartment on the ground floor.

Colouring of MARBLE. This is a nice art; and in order to ſucceed in it, the pieces of marble on which the experiments are tried, muſt be well poliſhed, and free from the leaſt ſpot or vein. The harder the marble is, the better will it bear the heat neceſſary in the operation; therefore alabaſter and the common ſoft white marble are very improper for performing theſe operations upon.

Heat is always neceſſary for opening the pores of marble, ſo as to render it fit to receive the colours: but the marble muſt never be made red-hot; for then the texture of it is injured, and the colours are burnt, and loſe their beauty. Too ſmall a degree of heat is as bad as one too great; for, in this caſe, though the marble receives the colour, it will not be fixed in it, nor ſtrike deep enough. Some colours will ſtrike even cold; but they are never ſo well ſunk in as when a juſt degree of heat is uſed. The proper degree is that which, without making the marble red, will make the liquor boil upon its ſurface. The menſtruums uſed to ſtrike in the colours muſt be varied according to the nature of the colour to be uſed. A lixivium made with horſe's or dog's urine, with four parts of quick-

† *Phil. Tranſ.* vol. lviii, 12.

lime and one of pot aſhes, is excellent for ſome colours; common ley of wood-aſhes is very good for others; for ſome, ſpirit of wine is beſt; and laſtly, for others, oily liquors, or common white-wine.

The colours which have been found to ſucceed beſt with the peculiar menſtruums, are theſe. Stone-blue diſſolved in ſix times the quantity of ſpirit of wine, or of the urinous lixivium, and that colour which the painters call *litmus*, diſſolved in common ley of wood-aſhes. An extract of ſaffron, and that colour made of buckthorn berries, and called by painters *ſap green*, both ſucceed well when diſſolved in urine and quicklime; and tolerably well when diſſolved in ſpirit of wine. Vermilion, and a very fine powder of cochineal, alſo ſucceed very well in the ſame liquors. Dragon's-blood ſucceeds in ſpirit of wine, as does alſo a tincture of logwood in the ſame ſpirit. Alkanet-root gives a fine colour: but the only menſtruum to be uſed for it is oil of turpentine; for neither ſpirit of wine, nor any lixivium will do with it. There is another kind of *ſanguis draconis*, commonly called *dragon's-blood in tears*, which, mixed with urine, gives a very elegant colour.

Beſides theſe mixtures of colours and menſtruums, there are other colours which muſt be laid on dry and unmixed. Theſe are, dragon's blood of the pureſt kind, for a red; gamboge for a yellow; green wax, for a green; common brimſtone, pitch, and turpentine, for a brown colour. The marble for theſe experiments muſt be made conſiderably hot, and then the colours are to be rubbed on dry in the lump. Some of theſe colours, when once given, remain immutable, others are eaſily changed or deſtroyed. Thus, the red colour given by the dragon's-blood, or by a decoction of logwood, will be wholly taken away by oil of tartar, and the poliſh of the marble not hurt by it.

A fine gold colour is given in the following manner: Take crude ſal ammoniac, vitriol, and verdigriſe, of each equal quantities. White vitriol ſucceeds beſt; and all muſt be thoroughly mixed in fine powder.

The ſtaining of marble to all the degrees of red or yellow, by ſolutions of dragon's-blood or gamboge, may be done by reducing theſe gums to powder, and grinding them with the ſpirit of wine in a glaſs mortar. But, for ſmaller attempts, no method is ſo good as the mixing a little of either of thoſe powders with ſpirit of wine in a ſilver ſpoon, and holding it over burning charcoal. By this means a fine tincture will be extracted; and with a pencil dipt in this, the fineſt traces may be made on the marble while cold; which, on the heating of it afterwards, either on ſand, or in a baker's oven, will all ſink very deep, and remain perfectly diſtinct on the ſtone. It is very eaſy to make the ground-colour of the marble red or yellow by this means, and leave white veins in it. This is to be done by covering the places where the whiteneſs is to remain with ſome white paint, or even with two or three doubles only of paper; either of which will prevent the colour from penetrating. All the degrees of red are to be given to marble by this gum alone; a ſlight tincture of it, without the aſſiſtance of heat to the marble, gives only a pale fleſh colour: but the ſtronger tinctures give it yet deeper; to this the aſſiſtance of heat adds greatly; and finally, the addition of a little pitch to the tincture, gives it a tendency to blackneſs, or any degree of deep red that may be deſired.

A blue colour may be given alſo to marble by diſſolving turnſol in lixivium, in lime and urine, or in the volatile ſpirit of urine; but this has always a tendency to purple, whether made by the one or the other of theſe ways. A better blue, and uſed in an eaſier manner, is furniſhed by the Canary turnſol, a ſubſtance well known among the dyers. This needs only to be diſſolved in water, and drawn on the place with a pencil: it penetrates very deeply into the marble; and the colour may be increaſed by drawing the pencil wetted afreſh ſeveral times over the ſame lines. This colour is ſubject to ſpread and diffuſe itſelf irregularly: but it may be kept in regular bounds, by circumſcribing its lines with beds of wax, or any ſuch ſubſtance. It is alſo to be obſerved, that this colour ſhould always be laid on cold, and no heat given even afterwards to the marble; and one great advantage of this colour is, that it is therefore eaſily added to marbles already ſtained with other colours, is a very beautiful tinge, and laſts a long time.—See alſo CHEMISTRY, n° 753.

Arundel MARBLES, marbles with a chronicle of the city of Athens, inſcribed on them (as was ſuppoſed) many years before our Saviour's birth; preſented to the the univerſity of Oxford by Thomas earl of Arundel, whence the name. See *ARUNDELIAN Marbles*.

MARBLED, ſomething veined or clouded, reſembling marble. See MARBLING.

MARBLED China-ware, a name given by many to a ſpecies of porcelain or china-ware, which ſeems to be full of cemented flaws. It is called by the Chineſe, who are very fond of it, *tſou tchi*. It is generally plain white, ſometimes blue, and has exactly the appearance of a piece of China which had been firſt broken, and then had all the pieces cemented in their places again, and covered with the original varniſh. The manner of preparing it is eaſy, and might be imitated with us. Inſtead of the common varniſh of the China-ware, which is made of what they call *oil of ſtone* and *oil of fern* mixed together, they cover this with a ſimple thing made only of a ſort of coarſe agates calcined to a white powder, and ſeparated from the groſſer parts by means of water, after long grinding in mortars. When the powder has been thus prepared, it is left moiſt, or in form of a ſort of cream, with the laſt water that is ſuffered to remain in it, and this is uſed as the varniſh. Our cryſtal would ſerve full as well as thoſe coarſe agates, and the method of preparation is perfectly eaſy. The occaſion of the ſingular appearance of this ſort of porcelain is, that the varniſh never ſpreads evenly, but runs into ridges and veins. Theſe often run naturally into a ſort of moſaic-work, which can ſcarce be taken for the effect of chance. If the marbled China be deſired blue, they firſt give it a general coat of this colour, by dipping the veſſel into a blue varniſh; and when this is thoroughly dry, they add another coat of this agate-oil.

Playing MARBLES, are moſtly imported from Holland; where it is ſaid they are made by breaking the ſtone-alabaſter, or other ſubſtance, into pieces or chips of a ſuitable ſize; theſe are put into an iron mill which turns by water; there are ſeveral partitions with raſps within, cut floatways, not with teeth, which turn conſtantly round with great ſwiftneſs; the friction againſt the raſps makes them round, and as they are formed, they fall out of different holes, into which ſize or chance throws them. They are brought from Nuremberg to Rotterdam, down the Rhine, and from thence diſperſed over Europe.

MARBLING, the method of preparing and colouring the marbled paper.

There are ſeveral kinds of marbled paper; but the principal difference of them lies in the forms in which the colours are laid on the ground; ſome being diſpoſed in whirls or circumvolutions; ſome in jagged lengths; and others only in ſpots of a roundiſh or oval figure. The general manner of managing each kind is, nevertheleſs, the ſame; being the dipping the paper in a ſolution of gum tragacanth, or, as it is commonly called, *gum-dragon*; over which the colours, previouſly prepared with ox-gall and ſpirit of wine, are firſt ſpread.

The peculiar apparatus neceſſary for this purpoſe, is a trough for containing the gum-tragacanth and the colours; a comb for diſpoſing them in the figure uſually choſen; and a burniſhing ſtone for poliſhing the paper. The trough may be of any kind of wood; and muſt be ſomewhat larger than the ſheets of paper for marbling which it is to be employed; but the ſides of it need only riſe about two inches above the bottom; for by making it thus ſhallow, the leſs quantity of the ſolution of the gum will ſerve to fill it. The comb may be alſo of wood, and five inches in length: but ſhould have braſs teeth, which may be about two inches long, and placed at about a quarter of an inch diſtance from each other. The burniſhing ſtone may be of Jaſper or agate: but as thoſe ſtones are very dear when of ſufficient largeneſs, marble or glaſs may be uſed, provided their ſurface be poliſhed to a greater degree of ſmoothneſs.

Theſe implements being prepared, the ſolution of gum tragacanth muſt be made, by putting a ſufficient proportion of the gum, which ſhould be white and clear from all foulneſſes, into clear water, and letting it remain there a day or two, frequently breaking the lumps and ſtirring it till the whole ſhall appear diſſolved and equally mixed with the water. The conſiſtence of the ſolution ſhould be nearly that of ſtrong gum-water uſed in miniature-painting; and if it appear thicker, water muſt be added; or if thinner, more of the gum. When the ſolution is thus brought to a due ſtate, it muſt be paſſed through a linen cloth; and being then put into the trough it will be ready to receive the colours.

The colours employed for red are carmine, lake, roſe pink, and vermilion; but the two laſt are too hard and glaring, unleſs they be mixed with roſe-pink or lake, to bring them to a ſofter caſt; and with reſpect to the carmine and lake, they are too dear for common purpoſes; for yellow, Dutch pink and yellow ochre may be employed: for blue, Pruſſian blue and verditer may be uſed:—for green, verdigriſe, a mixture of Dutch pink and Pruſſian blue, or verditer, in different proportions;—for orange, the orange-lake, or a mixture of vermilion, or red lead, with Dutch pink;—for purple, roſe-pink and Pruſſian blue.

Theſe ſeveral colours ſhould be ground with ſpirit of wine till they be of a proper fineneſs; and then, at the time of uſing them, a little fiſh-gall, or in default of it the gall of a beaſt, ſhould be added, by grinding them over again with it. The proper proportion of the gall muſt be found by trying them; for there muſt be juſt ſo much as will ſuffer the ſpots of colour, when ſprinkled on the ſolution of the gum-tragacanth, to join together, without intermixing or running into each other.

When every thing is thus prepared, the ſolutions of the gum-tragacanth muſt be poured into the trough; and the colours, being in a ſeparate pot, with a pencil appropriated to each, muſt be ſprinkled on the ſurface of the ſolution, by ſhaking the pencil, charged with its proper colour, over it: and this muſt be done with the ſeveral kinds of colour deſired, till the ſurface be wholly covered.

When the marbling is propoſed to be in ſpots of a ſimple form, nothing more is neceſſary: but where the whirls or-ſnail-ſhell figures are wanted, they muſt be made by means of a quill; which muſt be put among the ſpots to turn them about, till the effect be produced. The jagged lengths muſt be made by means of the comb above-deſcribed, which muſt be paſſed through the colours from one end of the trough to the other, and will give them that appearance: but if they be deſired to be pointed both ways, the comb muſt be again paſſed through the trough in a contrary direction; or if ſome of the whirls or ſnail-ſhell figures be required to be added, they may be yet made by the means before directed.

The paper ſhould be previouſly prepared for receiving the colours, by dipping it over-night in water; and laying the ſheets on each other with a weight over them. The whole being thus ready, the paper muſt be held by two corners, and laid in the moſt gentle and even manner on the ſolution covered with the colours, and there ſoftly preſſed with the hand, that it may bear every where on the ſolution. After which it muſt be raiſed and taken off with the ſame care, and then hung to dry acroſs a proper cord, ſubtended near at hand for that purpoſe; and in that ſtate it muſt continue till it be perfectly dry. It then remains only to give the paper a proper poliſh; in order to which, it is firſt rubbed with a little ſoap: and then muſt be thoroughly ſmoothed by the glaſs poliſhers, ſuch as are uſed for linen, and called the *calender glaſſes*. After which it ſhould be again rubbed by a burniſher of jaſper or agate; or, in default of them, of glaſs ground to the higheſt poliſh: for on the perfect poliſh of the paper depends in a great meaſure its beauty and value.

Gold or ſilver powders may be uſed, where deſired, along with the colour: and require only the ſame treatment as them, except that they muſt be firſt tempered with gum-water.

Marbling of books or paper is performed thus: Diſſolve four ounces of gum-arabic in two quarts of fair water; then provide ſeveral colours mixed with water in pots or ſhells; and, with pencils peculiar to each colour, ſprinkle them by way of intermixture upon the gum-water, which muſt be put into a trough or ſome broad-veſſel; then with a ſtick curl them, or draw them out in ſtreaks, to as much variety as may be done. Having done this, hold your book or books cloſe together, and only dip the edges in, on the top of the water and colours, very lightly; which done, take them off, and the plain impreſſion of the colours in mixture will be upon the leaves; doing as well the ends as the front of the book in the like manner.

Marbling a book on the covers is performed by forming clouds with aqua-fortis or ſpirit of vitriol mixed with ink, and afterwards glazing the covers. See the article Book-binding.

MARC-Antonio. See Raimondi.

MARCA (Peter de), one of the greateſt ornaments of the Gallican church, was born in Bearn, of an ancient family, in 1594. He firſt ſtudied the law, was made preſident of the parliament of Bearn, and going to Paris in 1639, was made a counſellor of ſtate: the good opinion entertained of his knowledge was confirmed by his *Hiſtory of Bearn*. By the king's order he publiſhed a work, *De concordia ſacerdotii et imperii, ſive de libertatibus eccleſiæ Gallicæ*, in refutation of a book that appeared under the title of *Optatus Gallus;* and on this account, when on the death of his wife he was nominated biſhop of Conſerans, the court of Rome refuſed the bulls in his favour, until by another book he explained away all he had ſaid on behalf of the ſtate, to the limitation of the papal power. He obtained his confirmation, after ſeven years ſuſpenſe, in 1648; was tranſlated to the archbiſhopric of Toulouſe in 1652; and was made miniſter of ſtate in 1658. He died at Paris in 1662, a ſhort time after he had received the bulls as the archbiſhop of that metropolis. After his death appeared his *Poſthumous works*, with prefaces, notes, &c. by M. Baluze. In all he wrote, he ſhowed great abilities and learning, but is reproached for accommodating them to his views of intereſt and ambition.

MARCASITE, in mineralogy. This name has long been given indifferently to all ſorts of minerals; to ores, pyrites, and to ſemimetals. Lately, it ſeems to be confined to pyrites, and Wallerius propoſes to confine it to ſuch pyrites as are regularly formed. This ſeems to be better than to leave it a vague and indeterminate ſignification, on account of the ambiguity and obſcurity which might thereby be introduced. See Pyrites.

MARCELLIANISM, the doctrines and opinions of the Marcellians, a ſect of ancient heretics, towards the cloſe of the ſecond century, ſo called from Marcellus of Ancyra, their leader, who was accuſed of reviving the errors of Sabellius. Some, however, are of opinion, that Marcellus was orthodox, and that they were his enemies the Arians, who fathered their errors upon him. St Epiphanius obſerves, that there was a great deal of diſpute with regard to the real tenets of Marcellus; but that, as to his followers, it is evident they did not own the three hypoſtaſes: for Marcellus conſidered the Son and Holy Ghoſt as two emanations from the divine nature, which, after performing their reſpective offices, were to return again into the ſubſtance of the Father; and this opinion is altogether incompatible with the belief of three diſtinct perſons in the Godhead.

MARCELLINUS (Ammianus.) See Ammianus.

MARCELLO (Benedict), a celebrated muſician, and deſcended from one of the moſt illuſtrious families in Venice. He lived in the beginning of the preſent century. We have of his compoſition, anthems, cantatas, and other works, which the connoiſſeurs rank as high as any of the numerous and excellent muſical compoſitions which the Italian ſchool has produced. "He is the Pindar of muſic, (ſays M. de la Borde). In boldneſs and regularity of deſign, he is the Michael Angelo of it. In analyſing his works, we diſcover a profound knowledge and great addreſs; but there is a difficulty attending the execution of them which is almoſt inſurmountable. It requires a voice poſſeſſed of great powers, and accuſtomed to the moſt extraordinary intervals." The chief of the family which ſtill exiſts was the ambaſſador of Venice to the Porte in 1770.

MARCELLUS (Marcus Claudius), a famous Roman general, who, after the firſt Punic war, had the management of an expedition againſt the Gauls. Here he obtained the *Spolia opima*, by killing with his own hand Viridomarus the king of the enemy. Such ſucceſs rendered him popular, and ſoon after he was entruſted to oppoſe Hannibal in Italy. He was the firſt Roman who obtained ſome advantage over this celebrated Carthaginian, and ſhowed his countrymen that Hannibal was not invincible. The troubles which were raiſed in Sicily by the Carthaginians at the death of Hieronymus, alarmed the Romans; and Marcellus, in his third conſulſhip, was ſent with a powerful force againſt Syracuſe. He attacked it by ſea and land; but his operations proved long ineffectual, and the invention and induſtry of Archimedes were able to baffle all the efforts, and to deſtroy all the great and ſtupendous machines and military engines of the Romans during three ſucceſſive years. The perſeverance of Marcellus at laſt obtained the victory. After this conqueſt, Marcellus was called upon by his country to oppoſe a ſecond time Hannibal. In this campaign he behaved with greater vigour than before; the greateſt part of the towns of the Samnites, which had revolted, were recovered by force of arms, and 3000 of the ſoldiers of Hannibal made priſoners. Some time after, in an engagement with the Carthaginian general, Marcellus had the diſadvantage: but on the morrow a more ſucceſsful ſkirmiſh vindicated his military character and the honour of the Roman ſoldiers. Marcellus, however, was not ſufficiently vigilant againſt the ſnares of his adverſary. He imprudently ſeparated himſelf from his camp, and was killed in an ambuſcade, in the 60th year of his age, in his 5th conſulſhip, A. U. C. 544. His body was honoured with a magnificent funeral by the conqueror, and his aſhes were conveyed in a ſilver urn to his ſon. Marcellus claims our commendation for his private as well as public virtues; and the humanity of a general will ever be remembered, who, at the ſurrender of Syracuſe, wept on the thought that many were going to be expoſed to the avarice and rapaciouſneſs of an incenſed ſoldiery, which the policy of Rome and the laws of war rendered inevitable.

MARCGRAVE, or Maargrave, a kind of dignity in Germany, anſwering to marquis: (ſee Marquis.) The word is derived from the German *Marche*, or *Marke*, which ſignifies "a frontier," and *Graffe*, "count, governor;" *Marcgraves* being originally governors of cities lying on the frontiers of a country or ſtate.

MARCH, Martius, the third month of the year, according to the common way of computing. See Month, and Year.

Among the Romans, March was the firſt month; and in ſome eccleſiaſtical computations, that order is ſtill preſerved; as particularly reckoning the number of years from the incarnation of our Saviour; that is, from the 25th of March.

It was Romulus who divided the year into months; to the firſt of which he gave the name of his ſuppoſed father *Mars*. Ovid, however, obſerves, that the people of Italy had the month of March before Romulus's time; but that they placed it very differently, ſome making it the third, ſome the fourth, ſome the fifth, and others the tenth month of the year.

In this month it was that the Romans ſacrificed to Anna Perenna; that they begun their comitia; that they adjudged their public farms and leaſes; that the miſtreſſes ſerved the ſlaves and ſervants at table, as the maſters did in the Saturnalia; and that the veſtals renewed the ſacred fire.

The month of March was always under the protection of Minerva, and always conſiſted of 31 days.—The ancients held it an unhappy month for marriage, as well as the month of May.

March, in the military art, is the moving of a body of men from one place to another. Nothing is laid down particularly concerning the marches of the Jewiſh armies; only thus much we may collect, that they made uſe of trumpets, to the different ſounds of which they prepared themſelves by packing up their baggage, putting themſelves in readineſs, and attending at the ſtandards, to wait the ſignal for marching. We are told that the army of the Iſraelites marched in general no more than one league in a day and an half; but this appears to hold good only of their progreſs through difficult roads: For Follard ſays they might, in an open country, march four leagues in a day or more. The Rabbins ſuppoſe that the Iſraelites marched in the ſame order they were placed in their camp. The Greeks, let the poſture of their affairs be what it would, never marched againſt their enemies till favourable omens encouraged the enterprize. An eclipſe of the moon, or any untoward accident, or the intervening of what they eſteemed an unlucky day, entirely prevented their march. But of all the Greeks the Lacedemonians were the moſt nice and ſcrupulous. The heavenly bodies directed all their motions; and it was an invariable maxim with them never to march before the full moon. The Greeks are particularly remarked by Homer for marching in good order and profound ſilence; whereas the Barbarian forces were all noiſe, clamour, and confuſion. It is needleſs to ſay any thing concerning the marches of the Roman armies, more than that they were performed with the greateſt order and diſpatch, inſomuch that their unexpected preſence frequently damped the ſpirits of their enemies. The Roman ſoldiers were enured to the military pace, that is, to walk 20 miles in five hours, though at the ſame time they carried burdens of ſixty pounds weight.

Of all the mechanical parts of war, in modern times, none is more eſſential than that of marching. It may be juſtly called the *key* which leads to all ſublime motions and manœuvres of an army; for they depend entirely on this point. A man can be attacked in four different ways; in the front, on both flanks, and in the rear: but he can defend himſelf, and annoy the enemy, only when placed with his face towards him. Hence it follows, that the general object of marching is reduced to three points only; to march forwards, and on both ſides, becauſe it is impoſſible to do it for any time backwards, and by that means face the enemy wherever he preſents himſelf.—The different ſteps to be made uſe of are three; ſlow, faſt, and oblique. The firſt is proper in advancing, when at a conſiderable diſtance from the enemy, and when the ground is unequal, that the line may not be broke, and a regular fire kept up without intermiſſion. The ſecond is chiefly neceſſary when you want to anticipate the enemy in occupying ſome poſt, in paſſing a defile, and, above all, in attacking an entrenchment, to avoid being a long while expoſed to the fire of the artillery and ſmall arms, &c. The third ſtep is of infinite conſequence, both in the infantry and cavalry; columns may be opened and formed into lines, and, *vice verſa*, lines into columns, by this kind of ſtep, in a leſſer ſpace, and conſequently in leſs time, than by any other method whatſoever. In coming out of a defile, you may inſtantly form the line without preſenting the flank to the enemy. The line may be formed, though ever ſo near to the enemy, with ſafety, becauſe you face him, and can with eaſe and ſafety protect and cover the motion of the troops, while they are coming out of the defiles, and forming. The ſame thing may be equally executed, when a column is to be formed in order to advance or retreat; which is a point of infinite conſequence, and ſhould be eſtabliſhed as an axiom.

The order of march of the troops muſt be ſo diſpoſed, that each ſhould arrive at their rendezvous, if poſſible, on the ſame day. The quarter-maſter-general, or his deputy, with an able engineer, ſhould ſufficiently reconnoitre the country, to obtain a perfect knowledge of it and the enemy, before he forms his routs.

Before a march, the army generally receives ſeveral days bread. The quarter-maſters, camp colour-men, and pioneers, parade according to orders, and march immediately after, commanded by the quarter maſter-general or his deputy. They are to clear the roads, level the ways, make preparations for the march of the army, &c. The *general*, for inſtance, beats at 2, the *aſſembly* at 3, and the army to march in 20 minutes after. Upon beating the *general*, the village, and general officer's guards, quarter and rear-guards, join their reſpective corps; and the army pack up their baggage. Upon beating the *aſſembly*, the tents are to be ſtruck, and ſent with the baggage to the place appointed, &c.

The companies draw up in their ſeveral ſtreets, and the rolls are called. At the time appointed, the drummers are to beat a march, and fifers play at the head of the line, upon which the companies march out from their ſeveral ſtreets, form battalions as they advance to the head of the line, and then halt.

The ſeveral battalions will be formed into columns by the adjutant-general, and the order of march, &c. be given to the general officers who lead the columns.

The cavalry generally march by regiments or ſquadrons. The heavy artillery always keeps the great roads, in the centre of the columns, eſcorted by a ſtrong party of infantry and cavalry. The field-pieces march with the columns.

Each ſoldier generally marches with 36 rounds of powder and ball, and 2 good flints; one of which is to be fixed in the cock of his firelock. The routes muſt be formed ſo that no columns croſs one another on the march.

MARCHAND (John-Louis), a native of Lyons, who ſhares with the celebrated *d'Aquin* the glory of having carried the art of playing on the organ to the higheſt degree of perfection. When very young he went to Paris; and happening to be in the chapel of the college of Louis the Great, when they were waiting for the organiſt to begin divine ſervice, he offered himſelf in his place. His playing gave ſo great ſatisfaction, that the Jeſuits kept him in the college, and ſupplied him with every neceſſary to perfect his talents. Marchand continued to play the organ of their chapel; and though many advantageous places were offered to him, he always refuſed to accept them. This diſintereſted conduct was not ſolely owing to his gratitude; for he was of ſo whimſical and independent a diſpoſition of mind, that he was equally careleſs about reputation and glory. He died at Paris in 1732, at the age of 63. From him we have two books of Pieces for the Harpſichord, much eſteemed by the connoiſſeurs.

MARCHAND (Profeſſor), was from his youth brought up at Paris, in the profeſſion of a bookſeller, and in the knowledge of books. He kept a regular correſpondence with ſeveral learned men, among whom was Bernard the continuator of the *Nouvelles de la Republique des Lettres,* and furniſhed this writer with the literary anecdotes of France. Marchand having embraced the Proteſtant religion, went to join Bernard in Holland, where he might be at liberty to profeſs his religious opinions. He continued the trade of bookſeller for ſome time; but afterwards quitted it, that he might dedicate himſelf wholly to the purſuits of literature. The hiſtory of France, together with a knowledge of books and authors, was always his favourite ſtudy. In the latter he was ſo eminently diſtinguiſhed, that he was conſulted from all parts of Europe. He was alſo one of the principal authors of the *Journal Litteraire,* one of the beſt periodical works which have appeared in Holland; and he furniſhed excellent extracts for the other journals. This valuable and learned man died at an advanecd age, the 14th of June 1756; and left the little fortune which he had, to a ſociety inſtituted at the Hague, for the education and inſtruction of a certain number of poor people. His library, which was excellently choſen for literary hiſtory, together with his manuſcripts, was left by his will to the univerſity of Leyden. From him we have, 1. *The Hiſtory of Printing,* a new edition of which has been promiſed by one of his friends. This work, which is full of notes and critical diſcuſſions, appeared in 1740 at the Hague, in 4to. There is ſuch a prodigious diſplay of erudition, and remarks and quotations are heaped together in ſuch confuſion, that when you get to the end of the chaos, you know not what concluſion to form concerning the points which have been diſcuſſed. Abbe Mercier, abbot of Saint-Leger, de Soiſſons, gave, in 1775, 4to, a ſupplement to this hiſtory, which is equally curious and accurate. 2. An Hiſtorical Dictionary, or Memoirs Critical and Literary, printed at the Hague in 1758, in two ſmall volumes, folio. In this work we meet with hiſtorical ſingularities, literary anecdotes, and a diſcuſſion of points of bibliography; but too great minuteneſs prevails in it, the ſtyle is deficient in point of purity, and the author is too much carried away by the heat and eagerneſs of his character. More erudition could not well be collected; eſpecially upon ſubjects which, at leaſt to the generality of readers, are ſo unintereſting. 3. A new edition of Bayle's Dictionary, and Letters of the *Cymbalum mundi,* &c.

MARCHANTIA, in botany: A genus of the natural order of algæ, belonging to the cryptogamia claſs of plants. The male calyx is peltated, and covered below with monopetalous corollæ; the antheræ are multifid; the female calyx is ſeſſile, campanulated, and polyſpermous. There are eight ſpecies; of which the moſt remarkable are, 1. The polymorpha, or great ſtar-handed marchantia, is a native of Britain, growing on the banks of rivulets, on ſhady moiſt rocks, the ſides of wells, and ſometimes bogs. The leaves are about three inches long; from half an inch to an inch broad, lying flat on the ground, and adhering cloſe to it by numerous downy radicles, which grow out of the middle and baſe of the leaf on the under ſide. Theſe leaves are ſituated on their edges, their upper ſurface of a dark, ſhining, green colour, reticulated with numerous, minute, rhomboidal, or lozenge-like ſcales; variouſly divided into obtuſe lobes, and in the middle by a blackiſh purple vein; their under ſide is of a paler green, and their ſubſtance coriaceous, and nearly opaque. There are three varieties, from one of which is produced a yellow powder, ſhowing a moſt curious and wonderful mechaniſm when examined by the microſcope. The leaves have a ſtrong aromatic ſmell, and acrid taſte; and are recommended in a decoction of ſkimmed milk, as good in the jaundice and other diſorders of the liver. 2. The conica, or conic-muſhroom marchantia, with warted leaves, grows on moiſt ſhady banks by the ſides of rivulets. Theſe leaves are broad, flat, about two inches long, dichotomous, obtuſely lobed, and lie upon one another. Their ſurface is of a pale-green gloſſy colour; curiouſly teſſelated with rhomboidal and hexagonal tubercles, each having a white veſicle or wart in the centre, with a puncture on its head. The leaves have a peculiar ſtrong fragrant ſmell, and acrid aromatic taſte. They are ſuppoſed to poſſeſs the ſame attenuating quality as the firſt, but in a higher degree. They are recommended as an antiſcorbutic, and for thinning the blood.

MARCHE, a province of France, bounded on the north by Berry, on the eaſt by Auvergne, on the weſt by Angoumois, and on the ſouth by Limoſin. It is about 55 miles in length, and 25 in breadth, and is pretty fertile in corn and wine.

MARCHENA, an handſome, ancient, and conſiderable town of Spain, in Andaluſia, with the title of a duchy, and a ſuburb as large as the town, ſeated in the middle of a plain, particularly fertile in olives, though very deſtitute of water. W. Long. 5. 20. N. Lat. 37. 20.

MARCHERS, or LORDS-MARCHERS, were thoſe noblemen that lived on the marches of Wales or Scotland; who, in times paſt, according to Cambden, had their laws, and *poteſtatem vitæ*, &c. like petty kings, which are aboliſhed by the ſtat. 27 H. 8. *c.* 26. and 1 Edw. 6. *c.* 10. In old records the lords marches of Wales were ſtyled *Marchianes de Marchia Walliæ*. See 1 & 2 *P.* & *M. c.* 15.

MARCHES (*marchia*), from the German *march*, i. e. *lines*, or from the French *marque*, viz. *ſignum*, (being the notorious diſtinction between two countries or territories), are the limits between England and Wales, or between England and Scotland, which laſt are divided into weſt and middle marches, 4 Hen. 5. *c.* 7. 22 Edw. 4. *c.* 8. 24 Hen. 8. *c.* 9. And there was formerly a court called the *court of the marches of Wales*, where pleas of debt or damages, not above the value of 50 pounds were tried and determined; and if the council of the marches held pleas for debts above that ſum, &c. a prohibition might be awarded. *Hill.* 14. *Car.* 1. *Cro. Car.* 38.

MARCHET, or MARCHETTA, a pecuniary fine, anciently paid by the tenant to his lord, for the marriage of one of the tenant's daughters. This cuſtom obtained, with ſome difference, throughout all England and Wales, as alſo in Scotland; and it ſtill continues to obtain in ſome places. According to the cuſtom of the manor of Dinover in Caermarthenſhire, every tenant at the marriage of his daughter pays ten ſhillings to the lord; which, in the Britiſh language, is called *gwabr-merched* i. e. *maid's fee*.

In Scotland, and the north parts of England, the cuſtom was, for the lord to lie the firſt night with the bride of his tenant; but this uſage was abrogated by king Malcolm III. at the inſtance of his queen; and, inſtead thereof, a mark was paid by the bridegroom to the lord: whence it was called *marcheta mulieris*. See *Borough-Engliſh*.

MARCIANA SILVA (anc. geog.), a foreſt ſituated between the Rauraci and the Danube, before it comes to be navigable; a part of Hercynia. Now Schwartzwald, or *Black Foreſt*, in the ſouth-weſt of Suabia, near the riſe of the Danube and Neckar.

MARCIANUS, a native of Thrace, born of an obſcure family. After he had for ſome time ſerved in the army as a common ſoldier, he was made private ſecretary to one of the officers of Theodoſius. His winning addreſs and uncommon talents raiſed him to higher ſtations; and on the death of Theodoſius II. A. D. 450, he was inveſted with the imperial purple in the eaſt. The ſubjects of the Roman empire had reaſon to be ſatisfied with their choice. Marcianus ſhowed himſelf active and reſolute; and when Attila, the barbarous king of the Huns, aſked of the emperor the annual tribute, which the indolence and cowardice of his predeceſſors had regularly paid, the ſucceſſor of Theodoſius firmly ſaid, that he kept his gold for his friends, but that iron was the metal which he had prepared for his enemies. In the midſt of univerſal popularity Marcianus died, after a reign of ſix years, in the 69th year of his age, as he was making warlike preparations againſt the barbarians that had invaded Africa. His death was long lamented; and indeed his merit was great, ſince his reign has been diſtinguiſhed by the appellation of the golden age. Marcianus married Pulcheria the ſiſter of his predeceſſor. It is ſaid, that in the years of his obſcurity he found a man who had been murdered, and that he had the humanity to give him a private burial; for which circumſtance he was accuſed of the homicide, and impriſoned. He was condemned to loſe his life; and the ſentence would have been executed, had not the real murderer been diſcovered, and convinced the world of the innocence of Marcianus.—Another emperor of the eaſt, A. D. 479, &c.

MARCIONITES, or MARCIONISTS, *Marcioniſtæ*, a very ancient and popular ſect of heretics, who, in the time of Epiphanius, were ſpread over Italy, Egypt, Paleſtine, Syria, Arabia, Perſia, and other countries: they were thus denominated from their author Marcion. Marcion was of Pontus, the ſon of a biſhop, and at firſt made profeſſion of the monaſtical life; but he was excommunicated by his own father, who would never admit him again into the communion of the church, not even on his repentance. On this he abandoned his own country, and retired to Rome, where he began to broach his doctrines.

He laid down two principles, the one good, the other evil: between theſe they imagined an intermediate kind of deity of a mixed nature, who was the creator of this inferior world, and the god and legiſlator of the Jewiſh nation: the other nations, who worſhipped a variety of gods, were ſuppoſed to be under the empire of the evil principle. Theſe two conflicting powers exerciſe oppreſſions upon rational and immortal ſouls; and therefore the ſupreme God, to deliver them from bondage, ſent to the Jews a being more like unto himſelf, even his ſon Jeſus Chriſt, clothed with a certain ſhadowy reſemblance of a body: this celeſtial meſſenger was attacked by the prince of darkneſs, and by the god of the Jews, but without effect. Thoſe who follow the directions of this celeſtial conductor, mortify the body by faſtings and auſterities, and renounce the precepts of the god of the Jews, and of the prince of darkneſs, ſhall after death aſcend to the manſions of felicity and perfection. The rule of manners which Marcion preſcribed to his followers was exceſſively auſtere, containing an expreſs prohibition of wedlock, wine, fleſh, and all the external comforts of life.

Marcion denied the real birth, incarnation, and paſſion of Jeſus Chriſt, and held them to be all apparent only. He denied the reſurrection of the body; and allowed none to be baptized but thoſe who preſerved their continence; but theſe, he granted, might be baptized three times. In many things he followed the ſentiments of the heretic Cerdon, and rejected the law and the prophets. He pretended the goſpel had been corrupted

corrupted by falſe prophets, and allowed none of the evangeliſts but St Luke, whom alſo he altered in many places as well as the epiſtles of St Paul, a great many things in which he threw out. In his own copy of St Luke he threw out the two firſt chapters entire.

MARCITES, Marcitæ, a ſect of heretics in the ſecond century, who alſo called themſelves the *perfecti*, and made profeſſion of doing every thing with a great deal of liberty and without any fear. This doctrine they borrowed from Simon Magus, who however was not their chief; for they were called *Marcites* from one Marcus, who conferred the prieſthood, and the adminiſtration of the ſacraments, on women.

MARCO Polo, Paolo, or *Paulo*. See Paulo.

MARCOMANNI, an ancient people of Germany, who ſeem to have taken their name from their ſituation on the limits or marches, to the eaſt of the Higher Rhine, and the north of the Danube. Cluverius allots to them the duchy of Wurtemburg, a part of the palatinate between the Rhine and the Necker, the Briſgau, and a part of Suabia, lying between the ſprings of the Danube and the river Bregnetz: they afterwards removed to the country of the Boii, whom they expelled and forced to withdraw more to the eaſt, occupying what is now called *Bohemia*. (Strabo, Velleius.)

MARCOSIANS, or Colobarsians, an ancient ſect in the church, making a branch of the Valentinians.

St Irenæus ſpeaks at large of the leader of this ſect, Marcus, who it ſeems was reputed a great magician. The Marcoſians had a great number of apocryphal books which they held for canonical, and of the ſame authority with ours. Out of theſe they picked ſeveral idle fables touching the infancy of Jeſus Chriſt, which they put off for true hiſtories. Many of theſe fables are ſtill in uſe and credit among the Greek monks.

MARCULUS, among the Romans, a knocker or inſtrument of iron to knock at the doors with.

MARCUS (Aurelius Antoninus). See Antoninus.

MARDIKERS, or Topasses, a mixed breed of Dutch, Portuguſe, Indians, and other nations, incorporated with the Dutch at Batavia, in the Eaſt Indies.

MARE, the female of the horſe kind. See the article Equus, and Horse.

Before a mare is covered, ſhe ſhould be in the houſe about ſix weeks, during which time ſhe ſhould be well fed with good hay and oats well ſifted; and in order to render her conception the more certain, near a quart of blood may be taken from each ſide of her neck, about five or ſix days before covering. Another method to bring a mare in ſeaſon and make her retain, is to give her, for the ſpace of eight days before you bring her to the horſe, about two quarts of hemp-ſeed in the morning, and as much at night; and if ſhe refuſes to eat it, to mingle it with a little bran or oats, or elſe to let her faſt for a while: and if the ſtallion alſo eat of it, it will greatly contribute to generation.

Mares go with foal 11 months, and as many days as they are years old; and therefore the propereſt time for covering them is in the beginning of June, that they may foal the May following, when there will be plenty of graſs, which will afford the mares a great abundance of milk for nouriſhing their foals. After covering, let her, for three weeks or a month, have the ſame diet as before, and be kept clean in the ſtable, with her feet well pared and thin ſhod: If ſhe cannot readily bring forth, hold her noſtrils ſo as to ſtop her taking wind; and if that will not do, diſſolve madder, to the quantity of a walnut, in a pint of ale and give it her warm. In caſe ſhe cannot void her ſecundine, or after-burden, boil two or three handfuls of fennel in running water; then put half a pint of that liquor into as much ſack, or, for want thereof, into a pint of ale, with a fourth part of ſalad-oil, mixed together, and pour it lukewarm into her noſtrils, holding them cloſe for ſome time. Otherwiſe, give her green wheat, or rye, the laſt of which is beſt.

If the mare has but little milk, boil as much as you can get from her with the leaves of lavender and ſpike, and bathe the udder with it warm, till the knobs and knots are diſſolved. She ſhould now drink only white water, which is bran put in water; give her alſo ſweet maſhes: and a month after foaling, let her have a maſh with ſome brimſtone or ſavin in it.

MAREOTIS, a lake in Egypt near Alexandria. Its neighbourhood was famous for wine; though ſome make the *Mareoticum vinum* grow in Epirus, or in a certain part of Libya, called alſo *Mareotis*, near Egypt.

MARETS (Jean de), a Pariſian, one of the fineſt geniuſes of the 17th century, became at laſt a viſionary and a fanatic. He was a great favourite of cardinal Richelieu, and poſſeſſed an employment of genius under him; for he was called upon to relax and divert him, after the fatigue of buſineſs, by facetious converſation. He uſed, in order to triumph over the virtue of women, when they objected to him the intereſt of their ſalvation, to lead them into atheiſtical principles. He was a member of the French academy from its firſt erection. He wrote ſeveral dramatic pieces, which were well received. He attempted an epic poem; but after ſpending ſeveral years about it, dropped the deſign to write books of devotion. He likewiſe wrote romances; but not ſuch virtuous ones as uſed to be written at that time. He was a declared enemy of the Janſeniſts. His viſions are well deſcribed by the Meſſieurs de Port Royal. He promiſed the king of France, by the explication of prophecies, the honour of overthrowing the Mahometan empire. In his laſt years he wrote ſomething againſt Boileau's Satires.

Marets (Samuel de), one of the moſt celebrated divines of the reformed church, was born in Picardy, in 1599. In 1620, he was ſettled in the church of Laon; but, in 1624, accepted a call to that of Sedan: in 1642, he obtained a profeſſorſhip at Groningen; and, from that time to his death, exerted himſelf ſo much in the ſervice of that univerſity, that it was reckoned one of the moſt flouriſhing in the Netherlands. His Syſtem of Divinity was found to be ſo methodical, that it was made uſe of at other academies; and at the end of it may be found a chronological table of all his works. Their number is prodigious; and their variety ſhows the extent of his genius.' He was moreover engaged, in many diſputes and controverſies, and died in 1673.

MARGARET (St), a celebrated virgin who, as is ſuppoſed, received the crown of martyrdom at Antioch in the year 271: the manner of her death is not known. The ancient martyrologiſts make no mention of her name, and ſhe did not become famous till the 11th century. There is no more foundation for what is ſaid concerning her relics and girdles than for the ſtories which are told of her life. A feſtival, however, is ſtill held in honour of her memory on the 20th of July: See *Baillet's Lives of the Saints* for that day. "Her actions (ſays this author) have been ſo falſified and altered, in the opinion even of Metaphraſtus, that the Romiſh church have not thought proper to inſert any of them into their breviary. The Orientals pay reverence to her by the name of *Saint Palagia* or *Saint Marina*, and the weſtern church by that of *Saint Geruma* or *Saint Margaret.*

Margaret, the daughter and heireſs of Florent count of Holland, who is famous on account of a ſtory repeated by a hundred compilers even of the preſent century. Having refuſed charity to a woman whom ſhe at the ſame time accuſed of adultery, ſhe was, as a puniſhment from God, brought to bed (A. D. 1276) of 365 children, partly boys and partly girls. The boys, it is added, were all named *John*, and the girls *Elizabeth*. This ſtory is repreſented in a large painting in a village not far from the Hague; and by the ſide of the painting are ſeen two large baſons of braſs, on which it is pretended the 365 children were preſented to be baptiſed. But if a picture is ſufficient authority for the truth of any thing, it is impoſſible to tell how many fables would be fully atteſted. It has been remarked, that the moſt ancient annals are altogether ſilent concerning this fact; and that it is related only by modern writers, who beſides do not agree with one another concerning either the date of time, or the life of the counteſs, or the number of the children; and in ſhort, that Naſſau, who was at that time biſhop of Utrecht, was called *John*, and not *Gui*, as the chronicles declare. Several learned men have endeavoured to trace the cauſe which could have given riſe to a relation ſo extraordinary. M. Struik fixed upon the epitaphs of the mother and ſon, which appeared to him worthy of ſome attention; and, in conformity to the dates which they bear, he ſuppoſed that the counteſs was brought to bed on Good-Friday 1276, which was the the 26th of March. Now, as the year then began on the 25th of the ſame month, there were only two days of the year elapſed when the counteſs was brought to bed, which circumſtance cauſed it to be ſaid *that ſhe had brought into the world as many children as there were days in the year*. In fact only two children are mentioned in hiſtory, John and Elizabeth. The fable thus explained is only a common event, wherein there is nothing of the marvellous, but in conſequence of a double meaning in the expreſſion. Later writers, who have not examined this circumſtance, have aſcribed 365 children to the counteſs. (*Journal des Savans*, February, 1758, on the General Hiſtory of the United Provinces.)

Margaret (counteſs of Richmond and Derby), the learned and pious mother of Henry VII. was born at Betſhoe in Bedfordſhire, in 1441; and was the ſole heireſs of John Beaufort duke of Somerſet, grandſon to John of Gaunt. Her mother was the heireſs of Lord Beauchamp of Powick. Whilſt yet very young, the great duke of Suffolk, miniſter to Henry VI. or rather to Queen Margaret, ſought her in marriage to his ſon; and ſhe was at the ſame time ſolicited by the king for his half-brother Edmund earl of Richmond. To the latter ſhe gave her hand. Henry VII. was the ſole fruit of this marriage, his father dying when he was but 15 weeks old. Her ſecond huſband was Sir Henry Stafford, knight, ſecond ſon to the duke of Buckingham; by whom ſhe had no iſſue. Soon after his death, which happened in the year 1482, ſhe ſought conſolation in a third huſband, Thomas Lord Stanley, who, in the firſt year of her ſon's reign, was created earl of Derby. He died in the year 1504, without iſſue, being then high conſtable of England. She ſurvived her lord not quite five years, dying at Weſtminſter in June 1509, in the 69th year of her age. She was buried in Henry VII.'s chapel; on the ſouth ſide of which was erected to her memory an altar-tomb of black marble, with her ſtatue of braſs.

From her funeral ſermon preached by her confeſſor biſhop Fiſher, who, ſays Ballard, knew the very ſecrets of her ſoul, we learn, "that ſhe poſſeſſed almoſt all things that were commendable in a woman, either in mind or body." She underſtood the French language perfectly, and had ſome knowledge of the Latin. She was devout even to auſterity, in humility romantic, profuſe in the encouragement of learning, and ſingularly chaſte; but this laſt virtue became conſpicuous only towards the latter end of a third marriage. "In her laſt huſband's days (ſays Baker), ſhe obtained a licence of him to live chaſte, whereupon ſhe took upon her the vow of celibacy." 'A boon (ſays Mr Walpole), as ſeldom requeſted, I believe, of a third huſband, as it probably would be eaſily granted.' Her life, from the turbulence of the times, and viciſſitude of her ſon's fortune, muſt neceſſarily have been ſubject to infinite diſquiet, which however ſhe is ſaid to have ſupported with ſingular fortitude.—She wrote, 1. The mirroure of golde for the ſinful ſoule, tranſlated from a French tranſlation of a book called *Speculum aureum peccatorum*. Emprynted at London, in Flete-ſtrete, at the ſign of St George, by Richard Pynſon, quarto, with cuts on vellum. 2. Tranſlation of the fourth book of Dr Gerſen's treatiſe of the imitation and following the bleſſed life of our moſt merciful Saviour Chriſt. Printed at the end of Dr Wm. Atkinſon's Engliſh tranſlation of the three firſt books, 1504. 3. A letter to the king; in Howard's collection. 4. By her ſon's order and authority, ſhe alſo made the Orders for great eſtates of ladies and noble women, for their precedence, and wearing of barbes at funerals, over the chin and under the ſame.

Margaret, the daughter of Woldemar III. king of Denmark, ſtyled the *Semiramis of the North*: ſhe ſucceeded her father in the throne of Denmark, her huſband in that of Norway, and the crown of Sweden was given her as a recompence for delivering the Swedes from the tyranny of Albert their king. Thus

poſſeſſed

poſſeſſed of the three kingdoms, ſhe formed the grand political deſign of a perpetual union, which ſhe accompliſhed, *pro tempore* only, by the famous treaty ſtyled the *union of Calmar*. She died in 1412, aged 59.

Margaret of Anjou, daughter of Bené D'Anjou, king of Naples, and wife of Henry VI. king of England; an ambitious, enterpriſing, courageous woman, Intrepid in the field, ſhe ſignaliſed herſelf by heading her troops in ſeveral battles againſt the houſe of York. and if ſhe had not been authoreſs of her huſband's misfortunes, by putting to death the duke of Glouceſter his uncle, her name would have been immortaliſed for the fortitude, activity, and policy with which ſhe ſupported the rights of her huſband and ſon, till the fatal defeat at Tewkſbury; which put an end to all her enterpriſes, the king being taken priſoner, and prince Edward their only ſon baſely murdered by Richard duke of York. Margaret was ranſomed by her father, and died in Anjou in 1482. See England, n° 202—226.

Margaret, (ducheſs of Newcaſtle.) See Cavendish.

MARGARITA, or Pearl-island, an iſland of South America, the middle of which is ſeated in W. Long. 64. 2. N. Lat. 11. 30. It was diſcovered by Columbus, and is about 35 leagues in compaſs. The ſoil is very fertile in maize and fruits, and abounds in paſture and verdant groves; yet is totally deſtitute of freſh water, which the inhabitants are obliged to bring from the continent. When the Spaniards firſt landed here, they found the natives buſy in fiſhing for oyſters. Columbus ordered ſome of the ſavages aboard his ſhip, who were ſo far from being terrified, that they very ſoon became familiar with the Spaniards. The latter at firſt imagined that the oyſters ſerved them for food; but on opening the ſhells, they found they contained valuable pearls. Upon this diſcovery they immediately landed, and found the natives ready to part with their pearls for the mereſt trifles. In proceſs of time the Spaniards built a caſtle called *Monpadre*, and employed prodigious numbers of Guinea and Angola negroes in the pearl-fiſhery; cruelly forcing them to tear up the oyſters from the rocks to which they ſtuck, during which time many of them were deſtroyed by the ſharks and other voracious fiſhes. In 1620, this iſland was invaded by the Dutch, who demoliſhed the caſtle upon it: ſince which time it has been in a manner abandoned by the Spaniards; and is now principally inhabited by the natives, to whom ſome particular indulgences were granted by the court of Spain, on account of their ready ſubmiſſion to Columbus.

MARGARITA, the Pearl, in natural hiſtory. See Pearl, and Mya.

MARGARITINI, are glaſs ornaments, made at Venice of ſmall glaſs tubes of different colours, which are blown at Murano, and which the women of the lower claſs wear about their arms and necks. The largeſt ſort are uſed for making roſaries. This work is performed with great diſpatch, the artiſan taking a whole handful of thoſe tubes at once, and breaking them off one after another with an iron tool. Theſe ſhort cylinders are mixed with a kind of aſhes, and put over the fire in an iron pan; and when the two ends begin to melt, by ſtirring them about with an iron wire, they are brought to a round figure; but care is taken not to leave them too long over the fire, leſt the hole through which they are to be ſtrung ſhould be entirely cloſed by the melting of the glaſs. There are ſeveral ſtreets at Franceſco de Vigna entirely inhabited by people whoſe ſole occupation is to make and ſtring theſe margaritini.

MARGATE, a ſea-port town of Kent, on the north ſide of the iſle of Thanet, near the North-Foreland. It is noted for ſhipping vaſt quantities of corn (moſt, if not all, the product of that iſland) for London, and has a ſalt-water bath at the poſt-houſe, which has performed great cures in nervous and paralytic caſes, and numbneſs of the limbs. It lies in St John's pariſh, which is a member of the port of Dover, at the diſtance of 14 miles, and 12 from Canterbury, and 72 from London: and in the ſummer ſeaſon is frequented for ſea-bathing, having become one of the principal watering-places for the idle, the opulent, and the invalid, where they meet with every requiſite accommodation; and the adjacent country abounds with moſt extenſive proſpects and pleaſant rides. E. Long. 1. 30. N. Lat. 51. 24.

MARHATTAS, Merhattahs, Marattas, or Mahrattas; a people of India, and by far the moſt conſiderable of all the Hindoo powers. The Marhattas boaſt a very high antiquity; profeſs the religion of Brama; ſpeak a dialect of the Sanſcrit language, in which they have introduced all the technical terms of Moghul adminiſtration; uſe a character of their own in writing, though not very different from ſome of the other tribes around them; and are divided into four caſts or claſſes of people, with the various ſubdiviſions of profeſſional diſtinction found over the reſt of Hindoſtan, but with this remarkable difference, that among the Marhattas every individual may, as in fact he occaſionally does, follow the life of a ſoldier.

As a nation inhabiting immemorially the country properly denominated *Marhat* or *Merhat*, and comprehending the greater part of the Paiſhwa's preſent dominion in the Decan, they were completely ſubjugated, and afterwards for many centuries depreſſed, firſt by the Patans, then by the Moghul conquerors of Delhi. At length, towards the end of Alemgeer's reign, they united, rebelled, and under the famous *Sewajee* or *Seeva-jee*, a leader of their own tribe, laid the foundations of their preſent vaſt empire, which has riſen gradually on the ruins of the Mahomedan power, as related under the article Hindoston, p. 531 par. 6.

Seeva-jee was ſucceeded by his ſon Rajah Sahou, who conſiderably extended the Marhatta dominions. When Rajah Sahou grew old and infirm, and the fatigues of government began to preſs heavy upon him, he appointed Biſſonat Balajeac Baahman born at Gokum, and leader of about 25,000 horſe, to the office of Paiſhwa or vicegerent.

Sketches relating to the Hindoos, vol. ii. p. 286, &c.

Rajah Sahou died without iſſue, but left nephews by his brother. The courrage and wiſdom of Balajee had gained him, during the latter years of the old Rajah, the affection and eſteem of all the nation. But under an appearance of modeſty and ſelf-denial, his prevailing paſſion was ambition; and the ſentiments of gratitude and loyalty were abſorbed in the deſire to command. He made uſe of the influence he had acquired under his benefactor ſo firmly to eſtabliſh his own power, that he not only retained the high office of Paiſhwa during his life, but tranſmitted it to his poſterity. The Marhattas, gradually forgetting a prince they knew nothing of, became accuſtomed to obey his vicegerent only; yet a certain reſpect for the royal race, or the dread of the conſequence of violating the ſtrong prejudice which the nation ſtill retains in favour of the family of its founder, have ſerved perhaps to preſerve it; and the deſcendants of Rajah Sahou's nephews yet exiſt, but are kept in captivity in the palace at Sattarah. The eldeſt is ſtyled Ram Rajah, or ſovereign; his name is on the ſeal and coin of the Marhatta ſtate; but his perſon is unknown, except to thoſe who immediately ſurround him. He reſides in his ſplendid priſon, encompaſſed with the appendages of eaſtern grandeur, but debarred of all power, and kept totally ignorant of buſineſs. The ſeat of government was transferred from the ancient royal reſidence of Sattarah to Poonah; and the uſurper, as well as his ſucceſſors, ſeem ſtill to have acted under the ſuppoſed authority of the depoſed prince, by their aſſuming no other title or character than that of Paiſhwa or prime-miniſter. From this change, the empire of the Ram-Rajah has been diſtinguiſhed only by the appellation of the *Paiſhwaſhip*, or otherwiſe the *Government of Poonah*, from the name of its preſent capital.

Biſſonat Balajee was ſucceeded as Paiſhwa by his eldeſt ſon Balajee Row (called alſo *Nana Saheb* or *Nanah Row*), who left three ſons, the eldeſt of whom, Balajee Pundit, ſometimes called Nanah Pundit, ſucceeded him. The two others were Rogobah or Ragonat Row, and Shamſheer Row.

Balajee Pundit left two ſons; Mahadava Row, who was Paiſhwa twelve years; and Narrain Row, who ſucceeded him.

During the latter part of life of Mahadava Row, his uncle Rogobah was confined to the palace at Poonah, for reaſons with which we are not acquainted. Mahadava Row died without iſſue; and upon the acceſſion of Narrain his brother, a youth of about 19 years of age, Rogobah in vain applied to be releaſed from his confinement. He is therefore ſuſpected of having entered into a conſpiracy with two officers in his nephew's ſervice, Somair Jing and Yuſuph Gardie, in order to procure that by force which he could not obtain by in treaty. The correſpondence between the conſpirators was carried on with ſo much ſecrecy, that the court had not the leaſt intimation or ſuſpicion of their deſign, till every avenue leading to the palace had been ſecured, and the whole building ſurrounded by the troops under the command of thoſe two officers. It is ſaid, that on the firſt alarm, Narrain Row ſuſpecting his uncle, ran to his apartment, threw himſelf at his feet, and implored his protection: "You are my uncle (ſaid he), ſpare the blood of your own family, and take poſſeſſion of a government which I am willing to reſign to you."

Somair and Yuſuph entered the room whilſt the young Paiſhwa was in this ſuppliant poſture. Rogobah, with apparent ſurpriſe and anger, ordered them to withdraw; but as they either knew him not to be ſincere, or thought they had proceeded too far to retreat, they ſtabbed Narrain with their poignards whilſt he clung to his uncle's knees.

The office of Paiſhwa being now vacant, the chiefs of the nation then at Poonah were aſſembled, and Rogobah being the only ſurvivor of the family of Biſſonat Balajee, to whoſe memory the Marhattas in thoſe parts are enthuſiaſtically attached, he was named to fill it. Being naturally of a warlike temper, he reſolved to undertake ſome foreign expedition; for beſides gratifying his paſſion for the field, he probably hoped, by the ſplendour of his exploits, to draw off the attention of the public from inquiring into the late cataſtrophe.

A pretence for war was not difficult to be found. He renewed the claim of his nation to the *chout*, and marched his army towards Hydrobad, the capital of the Nizam. The vigour of his meaſures procured him an accommodation of his demand; and he was proceeding to enforce a ſimilar one upon the Carnatic, when he received intelligence which obliged him to return haſtily to Poonah.

Although the Marhatta chiefs had acknowledged Rogobah as Paiſhwa, yet they and the people in general were much diſſatisfied with his conduct. The murderers of Narrain Row had not only eſcaped puniſhment, but, as was reported, had been rewarded. The crime was unexampled, and the perpetrators were beheld with uncommon horror and deteſtation. The Paiſhwa had hitherto ſo fully poſſeſſed the love of the people, that, till then, guards were conſidered as unneceſſary about the perſon of a man whoſe character rendered him inviolable. Every one therefore had free acceſs to his palace, and he relied with confidence for his ſafety upon the affections of thoſe who approached him.

Theſe reflections operated powerfully upon the minds of the Marhattas; but perhaps no violent conſequences would have enſued, had it not been diſcovered, ſoon after the departure of Rogobah from poonah, that the widow of Narrain Row, Ganga Baee, was pregnant. This determined their wavering reſolutions. Frequent conſultations were held among the principal men then in the capital; and it was finally reſolved to abjure the allegiance they had ſworn to Rogobah, and declare the child, yet unborn, to be the legal ſucceſſor of the late Paiſhwa.

A council of regency was immedietely appointed to govern the country until the child ſhould become of age; and it was agreed to reſerve their deliberations, in caſe it ſhould prove a female or die, till the event ſhould render them neceſſary. They who principally conducted theſe meaſures, and whoſe names will on that account be remembered, were Sackharam Babou and Balajee Pundit, called alſo Nanah Pher Nevees, from his having been long the principal ſecretary of the Marhatta ſtate. Nine other Marhatta leaders approved of theſe meaſures, and ſwore to mantain them.

As the firſt ſtep towards the execution of their plan, the widow of Narrain Row was conveyed to Poorandher, a fort of great ſtrength, ſituated on a high mountain, about 25 miles from Poonah. As ſoon as Rogobah received intimation of this revolution, he marched back towards the capital. But diſcontent had already infected his troops; ſome of the chiefs retired to their eſtates, and others joined the ſtandard of the regents. He however riſked a battle with an army of the revolters commanded by Trimbec Row, in which the latter was ſlain; but though he obtained a victory, the ſtrength of the confederates daily increaſed, while his own troops were diminiſhed by continual deſertions. He therefore found it neceſſary to retire to Ugein, and to ſolicit the aſſiſtance of the Marhatta chiefs Sindia and Holkar; but meeting with a refuſal, he went to Surat, and applied for ſuccour to the Engliſh.

Rogobah's ſucceſs in this application was the cauſe of two wars with the Marhatta ſtate; which, after much waſte of blood and treaſure, the Engliſh were obliged to conclude by relinquiſhing his claim, and acknowledging as legal Paiſhwa the ſon of Narrain Row, who was born about ſeven months after the death of his father. See India, n° 121 and 152; alſo Hindostan, n° 21.

The Marhatta dominions, as already obſerved, are governed by a number of ſeparate chiefs, all of whom acknowledge the Ram Rajah as their ſovereign; and all, except Moodajee Boonſalah, own the Paiſhwa as his vicegerent. The country immediately ſubject to the Paiſhwa, including all the hereditary territories that were left by the Rajah Sahou to the Ram Rajah, and thoſe that have been acquired and added to them ſince in his name, extends along the coaſt nearly from Goa to Cambay; on the ſouth it borders on the poſſeſſions of Tippoo Saib, eaſtward on thoſe of the Nizam and of the Marhatta Rajah of Berar, and towards the north on thoſe of the Marhatta chiefs Sindia and Holkar.

Moodajee Boonſalah, Rajah of Berar, poſſeſſes, beſides Berar, the greateſt part of Orixa (ſee Hindostan, p, 532, par. 6.) This prince being deſcended from the line of the Ram Rajah, eyes the power of the Paiſhwa, by whom a branch of his family is kept in ignominious confinement, with ill-will; has often refuſed to ſupport his meaſures; and, on ſome occaſions, has even ſeemed inclined to act againſt him.

Next to Moodajee, in point of importance, muſt be ranked Madajee Sindia, a bold and aſpiring chief, who poſſeſſes the greateſt part of the extenſive ſoubadary or government of Malva, together with part of the province of Candeiſh. The remainder is under the dominion of Holkar. Both he and Sindia pretend to be deſcended from the ancient kings of Malva. Sindia reſides chiefly at Ugein, near the city of Mundu, once the capital of theſe kings; and Holkar at Indoor, a town little more than 30 miles weſt of it. The dominions of theſe, and of ſome chiefs of leſs conſequence, extend as far as the river Jumna.

The meaſures purſued by the Marhattas for ſome years left little room to doubt that they aſpired at the ſovereignty of all Hindoſtan, or at leaſt at the expulſion of the Mahomedan princes: And in this laſt deſign they appear to have ſucceeded †, and to have gained a great acceſſion of territory, through the arms of Sindia, both by the capture of the cities of Agra and Delhi, with their territorial dependencies, and the conſequent captivity of the unfortunate monarch who ruled there as the laſt imperial repreſentative of the great Moghul race of Timur. "The whole of the dominion thus newly eſtabliſhed is of vaſt extent, ſtretching near 1200 miles along the frontiers of Tippoo and the Nizam in a north-eaſt direction, from Goa on the Malabar coaſt to Balaſore in Oriſſa adjoining to Bengal; and from thence north-weſterly 1000 miles more, touching the confines of the Britiſh and allied ſtates, on the borders of the Ganges and Jumna, to the territory of the Sieks at Panipat, rendered famous in 1761 for the laſt memorable defeat ſuſtained by the Marhrattas in their ambitious conteſt for empire with the united declining power of the Mahomedans. From this place, in a ſoutherly courſe, with great encroachment on the old eaſtern boundary of the Rajepoot country of Ajmere, it runs about 260 miles to the little Hindoo principality of Kotta, and thence ſouth-weſterly 540 miles further to the extreme point of the ſoubah of Gujerat at Duarka, including the whole of that fertile province; from whence, along the ſea-coaſts of Cambay and Malabar to Goa, the diſtance may be reckoned 800 miles. Thus the overgrown empire of the Marhattas may be ſaid to extend eaſt 19 degrees of longitude, near the parallel of 22 degrees north latitude, from the mouths of the Indus to thoſe of the Ganges, and about 13 degrees of latitude north, from the Kiſtnah to Paniput; comprehending at leaſt an area of 400,000 ſquare geographic miles, being conſiderably more than a third part of Hindoſtan, including the Decan, and equal perhaps in dimenſions to all the Britiſh and allied ſtates in India, with thoſe of Golconda and Myſore, taken together."

MARIA, or Sancta Maria, an iſland of the Indian Ocean, lying about five miles eaſt from Madagaſcar. It is about 27 miles long and five broad; well watered, and ſurrounded by rocks. The air is extremely moiſt, for it rains almoſt every day. It is inhabited by 500 or 600 negroes, but ſeldom viſited by ſhips.

Maria (St), a conſiderable town of South America, in the audience of Panama, built by the Spaniards after they had diſcovered the gold mines near it, and ſoon after taken by the Engliſh. It is ſeated at the bottom of the Gulf of St Michael, at the mouth of a river of the ſame name; which is navigable, and the largeſt that falls into the gulf. The Spaniards come here every year in the dry ſeaſon, which continues three months, to gather the gold-duſt out of the ſands of the neighbouring ſtreams; and carry away great quantities. W. Long. 148. 30. N. Lat. 7. 0.

Maria (St), a handſome and conſiderable town of Spain, in Andaluſia, with a ſmall caſtle. It was taken by the Engliſh and Dutch in 1702, for the archduke of Auſtria. It is ſeated on the Guadaleta, at the mouth of which is a tower and a cloſe battery. W. Long. 5. 33. N. Lat. 36. 35.

MARIAN islands. See *Ladrone-Iſlands*.

MARIANA (John), a learned Spaniſh hiſtorian, born at Talavera in the dioceſe of Toledo. He entered among the Jeſuits in 1554, at 17 years of age; and became one of the moſt learned men of his time. He was a great divine, a good humaniſt, and profoundly verſed in eccleſiaſtical as well as profane hiſtory. He taught

† *An Hiſtorical and Political View of the Decan.*

taught at Rome, in Sicily, at Paris, and in Spain; and died at Toledo in 1624. His principal works are, 1. An excellent hiſtory of Spain in 30 books; which he himſelf tranſlated from the Latin into Spaniſh, without ſervilely following his own Latin edition. 2. *Scholia*, or ſhort notes on the Bible. 3. A treatiſe on the changes the ſpecie has undergone in Spain; for which he was thrown into priſon by the duke of Lerma, the Spaniſh miniſter. 4. A famous treatiſe *De rege et regis inſtitutione*, which made much noiſe, and was condemned by the parliament of Paris to be burnt by the hands of the common hangman, for his aſſerting in that work, that it is lawful to murder tyrants. 5. A work on the faults of the government of the ſociety of Jeſuits, which has been tranſlated into Spaniſh, Latin, Italian, French, &c.

MARIANUS SCOTUS, an Iriſh monk, was related to the Venerable Bede, and wrote a chronicle which is eſteemed. He died in the abbey of Fuld in 1086, aged 58.

MARIBONE, or St Mary le Bone, or rather *Borne*, from the neighbouring brook, a pariſh of Middleſex, on the north-weſt ſide of London. The manor appears to have belonged anciently to the biſhop of London. The houſes in this pariſh are very numerous, compriſing ſeveral extenſive ſtreets and ſquares, which are every year increaſing. The Paddington road from Iſlington paſſes through this pariſh, which gives it communication with the eaſtern part of London without paſſing thro' the ſtreets. Here were three conduits erected about the year 1238, for ſupplying the city of London with water; but anno 1704, when it was plentifully ſerved by the New-River, the citizens let them out at 700 l. a-year for 43 years. There were two for receiving its water at the north-eaſt corner of the bridge on the river Tyburn, and over them ſtood the lord-mayor's banqueting-houſe, to which (the uſe of coaches being not then known) his lordſhip and the aldermen uſed to ride on horſeback, as their ladies did in waggons. This banqueting-houſe, after being many years neglected, was taken down in 1737, and the ciſterns arched over. This village, if it may be called by that name, is joined by new buildings to London. The old church, which was a mean edifice, was pulled down, and a new one erected in 1741. Beſides which it has a great number of chapels of every ſect and perſuaſion, and an extenſive work-houſe for the poor.

MARIDUNUM (anc. geog.), a town of the Demetæ in Britain. Now *Caer Mardin*, or *Caermerthen*, the capital of Caermarthenſhire.

MARIGALANTE, an iſland of North America, and one of the leaſt of the Caribbees, lies in N. Lat. 16. 32. and W. Long. 61. 5. from London, at the diſtance of four leagues from Guadaloupe, to the ſouth. The ſoil, produce, and climate, are pretty much the ſame as the other Caribbees. Columbus diſcovered it on his ſecond American voyage in 1483, and called it by the name of his ſhip Maria Galanta, or Gallant Mary. It is about ſix leagues long, and between three and four broad. Viewed at a diſtance from on board a ſhip, it appears like a floating iſland, becauſe, as it is for the moſt part flat, the trees ſeem to ſwim; but a nearer proſpect ſhows it to be interſected by ſome riſing grounds, which give a fine variety to the landſcape. The French ſettled here in 1648; and it was taken by the Engliſh in 1691, but the French ſoon got poſſeſſion of it again. It was again taken by the Britiſh in 1759, but afterwards reſtored at the peace 1763.—This iſland was thought, on its firſt diſcovery, to want water; but a charming running ſtream has in time been diſcovered, no leſs convenient than refreſhing and wholeſome, on the banks of which are ſome wealthy planters, and excellent plantations of ſugar. A little village in a ſmall bay is the capital of the iſland, and here the commandant reſides. The whole iſland is very capable of improvement; the ſoil being almoſt equally good, and the land riſing no where too high. The coaſt affords many little bays, and ſafe anchorage and ſhelter to ſhips.

MARINE, a general name for the navy of a kingdom or ſtate; as alſo the whole economy of naval affairs; or whatever reſpects the building, rigging, arming, equipping, navigating, and fighting ſhips. It comprehends alſo the government of naval armaments, and the ſtate of all the perſons employed therein, whether civil or military.

The hiſtory of the marine affairs of any one ſtate is a very comprehenſive ſubject, much more that of all nations. Thoſe who would be informed of the maritime affairs of Great Britain, and the figure it has made at ſea in all ages, may find abundance of curious matter in Selden's *Mare Clauſum*; and from his time to ours, we may trace a ſeries of facts in Lediard's and Burchet's, Naval Hiſtory, but above all in the Lives of the Admirals, by the accurate and judicious Dr Campbell.

MARINES, or *Marine Forces*, a body of ſoldiers raiſed for the ſea-ſervice, and trained to fight either in a naval engagement or in an action aſhore.

The great ſervice of this uſeful corps was manifeſted frequently in the courſe of the war before laſt, particularly at the ſiege of Belleiſle, where they acquired a great character, though lately raiſed and hardly exerciſed in military diſcipline. At ſea they are incorporated with the ſhip's crew, of which they make a part; and many of them learn in a ſhort time to be excellent ſeamen, to which their officers are ordered by the admiralty to encourage them, although no ſea-officer is to order them to go aloft againſt their inclination. In a ſea-fight their ſmall-arms are of very great advantantage in ſcouring the decks of the enemy; and when they have been long enough at ſea to ſtand firm when the ſhip rocks, they muſt be infinitely preferable to ſeamen if the enemy attempts to board, by raiſing a battalion with their fixed bayonets to oppoſe him.

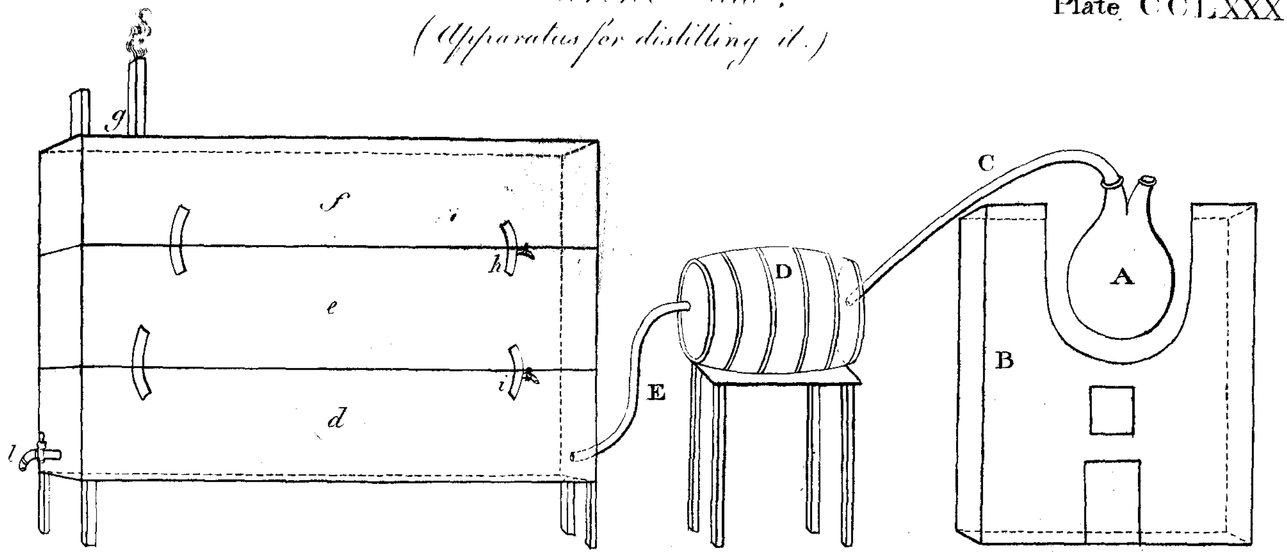
The ſole direction of the corps of Britiſh marines is veſted in the lords commiſſioners of the admiralty; and in the admiralty is a diſtinct apartment for this purpoſe. The ſecretary to the admiralty is likewiſe ſecretary to the marines, for which he has a ſalary of L. 300 a-year; and he has under him ſeveral clerks for the management of his department.

The marine forces of Great-Britain in the time of peace are ſtationed in three diviſions; one of which is quartered at Chatham, one at Portſmouth, and another at Plymouth. By a late regulation, they are ordered to do duty at the ſeveral dock-yards of thoſe ports, to prevent embezzlement of the king's ſtores, for which a captain's guard mounts every day; which certainly requires great vigilance, as ſo many abuſes of this kind

Plate CCLXXX

Marine Acid.

(Apparatus for distilling it.)



MASONRY.

Fig. 2.

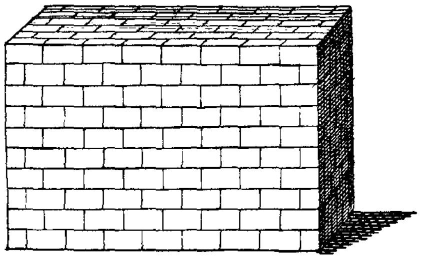


Fig. 1.

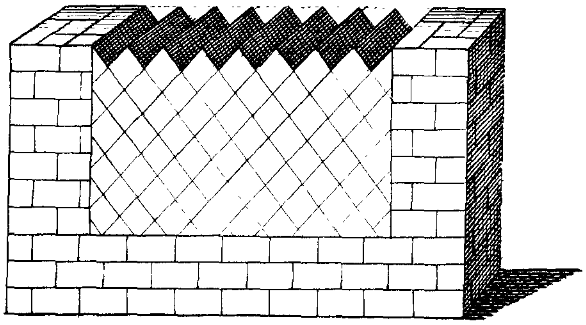


Fig. 8.

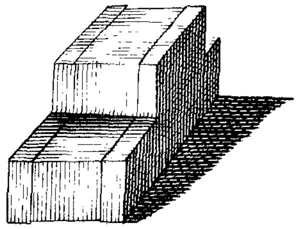


Fig. 3.

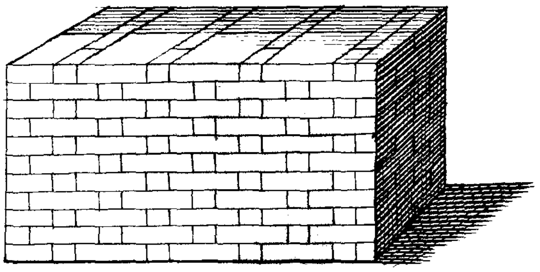


Fig. 5.

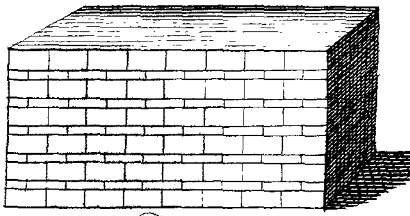


Fig. 4.

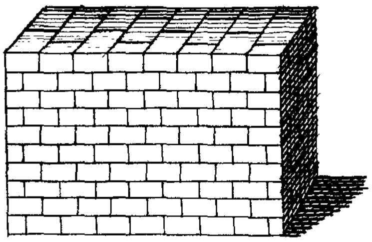


Fig. 6.

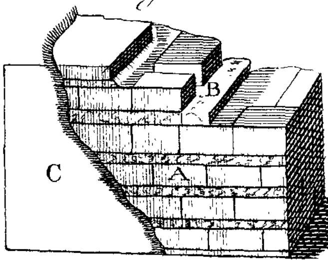
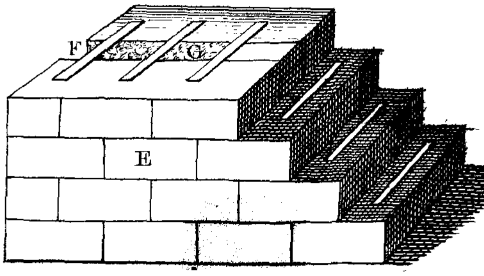


Fig. 7.



Scot Philad.a
30

have been committed, that many of the inhabitants, who have been long uſed to an infamous traffic of this kind, expect theſe conveyances at certain periods as their due, and of courſe reſent this regulation in the higheſt degree as an infringement of their liberties Britiſh ſubjects.

The marine corps are under the command of their own field-officers, who diſcipline them, and regulate their different duties.—His late majeſty in 1760 formed a new eſtabliſhment of marine officers, entitled the *general, lieutenant-general,* and *three colonels* of marines (one for each diviſion), to be taken from officers in the royal navy. The two firſt are always enjoyed by flag-officers, the laſt by poſt-captains only. This eſtabliſhment was formed to reward ſuch officers who diſtinguiſhed themſelves in the ſervice of their country.

Marine-diſcipline, is the training up ſoldiers for ſea ſervice, in ſuch exerciſes as the various poſitions of the firelock and body, and teaching them every manœuvre that can be performed on board ſhips of war at ſea. See Exercise.

Marine-Chair, a machine invented by Mr Irwin for viewing the ſatellites of Jupiter at ſea, and of courſe determining the longitude by their eclipſes. An account of it is given in the *Journal Eſtranger* for March 1760. An account of its accuracy was publiſhed the year following by M. de L'iſle aſtronomer in the imperial academy of Peterſburg: but notwithſtanding the encomiums beſtowed upon it by this gentleman, it hath never come into general uſe: and therefore we may conclude, that it is much inferior to the inventions of Mr Harriſon for the ſame purpoſe. See Harrison and Longitude.

Marine ſurveyor, is the name of a machine contrived by Mr H. de Scumeraz for meaſuring the way of a ſhip in the ſea. This machine is in the form of the letter Y, and is made of iron or any other metal. At each end of the lines which conſtitute the angle or upper part of that letter, are two pallets, not much unlike the figure of the log; one of which falls in the ſame proportion as the other riſes. The falling or pendant pallet meeting a reſiſtance from the water, as the ſhip moves, has by that means a circular motion under water, which is faſter or ſlower according as the veſſel moves. This motion is communicated to a dial within the ſhip, by means of a rope faſtened to the tail of the Y, and carried to the dial. The motion being thus communicated to the dial, which has a bell in it, it ſtrikes exactly the number of geometrical paces, miles, or leagues, which the ſhip has run. Thus the ſhip's diſtance is attained; and the forces of tides and currents may alſo be diſcovered by this inſtrument: which, however, has been very little uſed.

Marine-Acid, a name given to one of the component parts of ſea-ſalt. An account of various methods of procuring this acid from common ſalt, of moſt of its chemical properties, and of ſeveral uſes it may be put to in the arts, is given under the articles Chemistry, *Colour-making* Bleaching, &c. M. Chaptal obſerves, that the marine acid cannot be obtained by diſtilling ſalt with powdered flints. He made the experiment by mixing ten pounds of flints with two pounds of ſea-ſalt, but obtained only a maſs of the colour of litharge, and the fumes were not preceptibly acid. Clay will decompoſe this ſalt for once, but not in the ſmalleſt degree if uſed a ſecond time; which ſhows that in all probability the decompoſition is owing to a portion of vitriolic acid contained in the clay. In France there is a very impure kind of ſoda named *Blanquette*, which, according to M. Chaptal's analyſis, contains 21 pounds of ſea-ſalt out of 25; and yet, when treated with vitriolic acid, affords little or no ſpirit of ſalt, but abundance of volatile ſpirit of ſulphur. Our author aſcribes this to the quantity of charcoal contained in the blanquette, which unites with the vitriolic acid and volatilizes it: and his conjectures appeared to be right; becauſe, if the coal is deſtroyed by calcination, the blanquette yields marine acid in proportion to the quantity of common ſalt it contains.

Under the article Bleaching we have taken notice of the properties of the dephlogiſticated acid of ſea-ſalt in whitening cloth; but though this has been often attempted, it does not appear likely to come into practice; nor does even the offer of a premium ſeem to encourage the bleachers of Britain to make any ſerious endeavour to introduce it. This we can only account for in two ways: 1. From the very noxious and ſuffocating ſmell attending the operation, by which the health, and even the life of thoſe who prepare this acid in an unſkilful manner, as well as of the bleachers who make uſe of it, are greatly endangered. 2. From the exceſſive waſte of vapour in the ordinary mode of preparation, which renders the liquid too dear for ordinary uſe.

To avoid theſe inconveniences, it has been recommended by chemiſts to force the vapour violently into larger quantities of water, and by compreſſing the fumes to a great degree, to render the liquid extremely ſtrong, and then dilute it when it is to be uſed. By this means, however, the vapour forces out at the joinings of the diſtilling veſſel in ſuch a manner that no lute can keep it in; at the ſame time that the liquor being impregnated with an over-proportion of gas, lets go the ſuperfluous quantity as ſoon as the preſſure is taken off, thereby loſing its power, and annoying with its noxious and indeed poiſonous ſmell every one who comes near it. The trouble attending this preparation may be eaſily judged from the following deſcription of the proceſs given by M. Chaptal.

"To extract the acid (ſays he), I place a large glaſs alembic, of one ſingle piece, upon a ſand-bath. To the alembic I adapt a ſmall receiver; and to the receiver three or four ſmall bottles nearly filled with diſtilled water, and arranged according to the method of Mr Woulfe. I diſpoſe the receiver and bottles in a ciſtern, the places of junction being luted with fat lute, and ſecured with rags ſoaked in the lute of lime and whites of eggs. Laſtly, I ſurround the bottles with pounded ice. When the apparatus is thus diſpoſed, I introduce into the alembic half a pound of manganeſe of Cevennes, and pour upon it, at ſeveral repetitions, three pounds of fuming muriatic acid. The quantity of acid which I pour at once is three ounces; and at each time of pouring, a conſiderable effervеſcence is raiſed. I do not pour a new quantity until nothing more comes over into the receivers. This method of proceeding is indiſpenſably neceſſary when the operator is deſirous of making his proceſs with a definite quantity of materials: for if too large a quantity of acid be poured on at once, it is impoſſible to reſtrain the vapours: and the efferveſcence will throw a quantity of manganeſe into the receiver. The vapours which are developed by the effuſion of muriatic acid are of a greeniſh-yellow colour, and communicate this colour to the water when they combine with it. When this vapour is concentrated by means of the ice, and the water is ſaturated with it, it forms a ſcum on the ſurface, which is precipitated through the liquid, and reſembles a congealed oil. It is neceſſary to aſſiſt the action of the muriatic acid by means of a moderate heat applied to the ſand bath. The ſecure luting of the veſſels is alſo an eſſential circumſtance; for the vapour which might eſcape is ſuffocating, and would not ſuffer the chemiſt to inſpect his operation cloſely. It is eaſy to diſcover the place where it eſcapes through the lutes by running a feather dipped in volatile alkali over them; the combination of theſe vapours inſtantly forms a white cloud, which renders the place viſible where the vapour eſcapes.

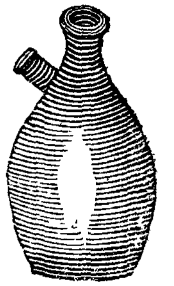
“ The ſame oxygenated muriatic acid may be obtained by diſtilling in a ſimilar apparatus ten pounds of marine ſalt, three or four pounds of manganeſe, and ten pounds of *ſulphuric* (vitriolic) acid.

“ Mr Reboul has obſerved, that the concrete ſtate of this acid is a cryſtallization of it, which takes place at three degrees of temperature below the freezing point of Reaumur. The forms which have been obſerved are thoſe of a quadrangular priſm, truncated very obliquely, and terminated by a lozenge. He has likewiſe obſerved hollow hexahedral pyramids on the ſurface of the liquor.

“ To make uſe of the oxygenated acid in the arts, and in order to concentrate a greater quantity in a given volume of water, the vapour is made to paſs thro' a ſolution of alkaline ſalt. A white precipitate is at firſt formed in the liquid: but a ſhort time afterwards the depoſition diminiſhes, and bubbles are diſengaged which are nothing but the carbonic acid. In this caſe two ſalts are formed, the oxygenated muriate and the ordinary muriate. The mere impreſſion of light is ſufficient to decompoſe the former, and to convert it into common ſalt. This lixivium contains indeed the oxygenated acid in a ſtronger proportion. The execrable ſmell of the acid is much weakened. It may be employed for various uſes with the ſame ſucceſs, and with great facility; but the effect is very far from correſponding with the quantity of oxygenated acid which enters into this combination, becauſe the virtue of a great part is deſtroyed by its union with the alkaline baſis.—The oxygenated muriatic acid has an exceſſively ſtrong ſmell. It acts directly on the larynx, which it ſtimulates, excites coughing, and produces violent headaches.”

The apparatus recommended by Mr Berthollet is on the ſame plan with M. Chaptal's, though the ſcale is much larger. Both are evidently troubleſome; and cannot by any means be introduced into ordinary practice, where the *preparation*, as well as the method of uſing the liquor muſt be left to workmen of little underſtanding and leſs attention. For theſe it is neceſſary to have an apparatus which may not readily be broken, which requires little trouble or dexterity in the uſing, and which may prepare great quantities at once. The principal difficulty is the condenſation of the fumes. To attempt violently to force ſteam of any kind into water is always improper, and ſeldom anſwers any purpoſe, unleſs when for chemical experiments the liquors are wanted of extraordinary ſtrength. Water naturally attracts a certain proportion of every kind of vapour; and when once this natural attraction is ſatisfied, it is vain to attempt to force more into it. In proportion to the quantity of ſurface expoſed to the ſteam, water will imbibe it in ſhorter or longer time; and therefore a broad ſhallow veſſel is always preferable to a round or narrow deep one where diſtillations of this kind are to be performed.

It muſt alſo be obſerved, that the vapour with which the water is to be impregnated, ought not to ruſh out of the diſtilling veſſel with too great haſte; as in this caſe a great quantity will unavoidably be loſt, by reaſon of the water not having time to abſorb it all. To avoid this, matters ſhould be managed in ſuch a manner, that, without ſenſibly interrupting the operation the vapour may iſſue from the diſtilling veſſel gradually, and without ſudden exploſions: by which means the water will imbibe as faſt as the veſſel diſtils for a certain time; and in order to preſerve all the vapour, there ought to be ſeveral receivers, one above the other, communicating by pipes, that the vapour which does not condenſe in one may do ſo in the other. The following apparatus may be uſed with ſucceſs:



1. For the diſtilling veſſel. A large bottle of common brown earthenware, ſuch as is repreſented on the margin, is undoubtedly the cheapeſt, and moſt eligible diſtilling-veſſel that can be made uſe of; as it is not liable to break, and may be uſed for a long time without being corroded. It may be placed in a ſand-bath; or in caſe it is luted, it may be put on an open fire, which, however, ought not to be raiſed to any great height.

2. The receivers ought to be large ſquare ciſterns of wood, covered over on the inſide with white wax, on which the acid has no effect; and they may be placed, for the greater convenience, one above the other, with cocks ſo ſituated, that the water of the upper ciſterns may be diſcharged into the lower ones as occaſion requires. The lowermoſt ciſtern muſt alſo be furniſhed with a cock, for running off the liquor into the veſſels in which the cloth is to be ſteeped.

3. The bottle muſt be furniſhed with a glaſs tube to convey the ſteam from it into the receiver; but to prevent any of the acid from getting in amongſt the liquor deſigned for bleaching, it will be neceſſary to have a ſmall caſk interpoſed betwixt it and the receivers; which will alſo prevent the liquor from being dirtied by any ſudden ſwell of the mixture in the bottle.

4. It will be convenient, and which may be eaſily accompliſhed in moſt bleaching-houſes, to have a ſmall ſtream of clear water running into it, higher than the level of the uppermoſt reſervoir; by which means they can all be filled to a ſufficient depth with very little trouble. The apparatus then will be as repreſented on Plate CCLXXX. where A is the bottle containing the mixture; B the ſand pot, furnace, door, and aſh-hole; C the glaſs tube to convey the ſteam into the

caſk D, placed there on purpoſe to catch any acid which may diſtil, or ſmall quantity of the mixture which may boil over. E is another glaſs-tube communicating with the lowermoſt reſervoir *d*, into which it conveys the ſteam to be abſorbed by the water lying in its bottom. The three ciſterns communicate on their upper parts by means of the pipes *m* and *n*, by which the ſteam which does not condenſe in the lower reſervoir is conveyed to the middle one *e*, and that which does not condenſe in the middle one is conveyed to the upper one *f*; in which a vent is finally given to it at *g*; or if it is found that three reſervoirs are not ſufficient, there may be one or more placed on the top of theſe, in a manner ſimilar to what we have already deſcribed.

The operation is to be begun by putting into the bottle A, a quantity of ſtrong ſpirit of ſalt diluted with at leaſt four times its quantity of water, ſufficient to fill ſomewhat more than one half of it. The mangaueſe, reduced to as fine a power as poſſible, is to be made up into ſmall pellets or balls, with water, and thrown in at the lateral neck of the bottle. A few only are to be thrown in at once, and the mouth inſtantly ſtopped with a cork; a briſk efferveſcence will immediately enſue, and a conſiderable quantity of vapours will come over without heat, paſſing thro' the pipes C and E into the reſervoir *d*; from thence through *m* into the reſervoir *e*, and from *e* into *f*: the ſmall quantity which ſtill remains uncondenſed paſſing out at the vent *g*, which ought to be under a chimney, or to be fitted with an upright pipe going through the roof of the houſe.

A fire being applied, the vapour will begin to iſſue out through the pipes in greater quantities, but by the time the liquor has begun to boil, the dephlogiſticated vapour will have entirely paſſed over. This may be eaſily known to be the caſe by the heat of the glaſs tubes. On this the cork is to be pulled out, and two or three more pellets of manganeſe are to be thrown in, and the mouth ſtopped up as quickly as poſſible. The vapour from theſe will be quickly diſſipated, and the operation muſt be repeated until no more efferveſcence ariſes upon throwing in the manganeſe. When this is the caſe, a freſh quantity of ſpirit of ſalt diluted, but not ſo much as the preceding, is to be added, and this again treated with more manganeſe as before; continuing the operation till the bottle be ſuppoſed as full as is convenient for the operation. The whole muſt now be allowed to cool; and it would be proper to have another furnace, ſand pot, and bottle, to join immediately to the reſervoirs, that the operation may not be interrupted.—The water in the lowermoſt reſervoir will always be moſt ſtrongly impregnated, and may be known to be of ſufficient ſtrength when a few threads of flax put into it are viſibly whitened in two or three minutes. It is then to be let off into the large reſervoir for ſteeping the cloth; the water in the middle receiver, which is alſo partly impregnated with dephlogiſticated gas, muſt be let down into the lowermoſt one by turning the cock of the pipe *i*, which runs off the water to the bottom. In like manner, the water in the upper ciſtern *f* is let down into the middle ciſtern *e*, by turning the cock belonging to the pipe *h*, while that in *f* is to be replaced by freſh water from the ſtream which runs into the houſe.—The reſiduum of the diſtillation is a ſolution of manganeſe in common ſpirit of ſalt, from which the metal may be precipitated by cauſtic volatile alkali, and the liquid will afford ſal ammoniac: the precipitate, by being calcined again till it grows black, may be uſed as freſh manganeſe; but conſidering the low price of this mineral, we can ſcarce recommend this proceſs as worth the trouble. It is certain, however, that a great part of the marine-acid will remain undecompoſed, even after we have added as much manganeſe as will excite any efferveſcence. This may be extemporaneouſly recovered by pouring into the diſtilling veſſel a ſmall quantity of oil of vitriol. This expels the marine acid from the manganeſe with which it is united, and renders it again capable of acting upon more; but when the addition of a ſmall quantity of this acid has no effect in producing the proper gas, we may then be ſure that the operation is totally finiſhed. The reſiduum is now a combination of manganeſe with vitriolic acid, and may be decompoſed by volatite alkali, ſo that it can ſtill be of uſe to the makers of ſpirit of hart's-horn and ſal ammoniac.

Thus we ſee, that by a very eaſy proceſs, without the ſmalleſt danger to the health of the workman, an unlimited quantity of dephlogiſticated ſpirit of ſalt may be prepared of a ſufficient ſtrength to anſwer every uſeful purpoſe; and it is evident from the foregoing deſcription of the proceſs, that the moſt is made of the materials, ſo that we can ſcarce expect a cheaper method. The practice of mixing together the ſalt, oil of vitriol, and manganeſe, all together in the diſtilling veſſel, is by no means to be commended; for thus the matter always run into an hard lump, which cannot be got out without breaking the veſſel; and the vapour is, beſides, forced out with ſuch rapidity, that great part of it is unavoidably loſt.

The next and moſt important conſideration is the method of uſing the liquor after it is diſtilled. And here, as the volatility of the gas is the principal obſtacle to the preſervation of its ſtrength, it is indiſpenſibly neceſſary to have it to run from a covered ſpout into a covered veſſel where the cloth is placed. It is likewiſe a matter of importance to have the cloth ſpread among the liquid in ſuch a manner that the power of the gas may be equally diffuſed over its whole ſurface; for if it lies in folds upon one another, it will undoubtedly be ſpotted, let us do as we will. To prevent this in the moſt effectual manner, it is neceſſary to roll the cloth as is done by dyers to make their colours ſtrike equally; for this operation we may account a kind of dyeing *white*; and the ſame precautions are undoubtedly neceſſary to make this colour equal as any other. It is probable, that veſſels and rollers might be ſo conſtructed, that a number of pieces of cloth might be whitened all at once; and the operation of driving the rollers might be performed by a machine driven by water.

With regard to the uſe of this liquid itſelf, it muſt be obſerved, that though very cheap when made as above directed, yet water itſelf is ſtill cheaper; and whatever can be done by mere water, ought to be previouſly done to the cloth before it is immerſed in the dephlogiſticated liquor. With this view it ought to undergo a long continued but gentle fulling, a ſtream of of warm water conſtantly running upon it all the while. Thus an incredible quantity of filth will be ſeparated: and it will be matter of ſurpriſe to thoſe who have not made the experiment, to be told, that they could not, in 24 hours, waſh a piece of cloth as it comes from the weaver ſo clean in repeated quantities of water but that it would ſtill render the laſt quantity dirty. Cloth, when treated in this manner for a conſiderable time, will be very nearly as well whitened as that which has been boiled in alkali. Boiling in water has not an effect nearly equal to that of gentle beating while the cloth is immerſed in water, neither are violent ſtrokes ſo uſeful as thoſe which are gentle; and it might undoubtedly be worth while to contrive a machine for the purpoſe of giving this gentle fulling, which, without injuring the texture of the cloth, might be continued for a long time, and would be advantageous either on the old or new plan of bleaching.

If this method of fulling ſhould not be adopted, that of *ſtreaming* the cloth, or immerſing it for ſome time in a ſtream of running water, would be of very conſiderable uſe as a preparation: but boiling with alkaline ſalt ſeems more advantageouſly to be omitted till after the cloth has undergone two or three operations in the dephlogiſticated liquor; becauſe this liquid, even when very weak, will cleanſe conſiderably, and extract a great quantity of ſordes, which would load the alkali and deſtroy its force.

Having prepared the cloth in ſome of the methods abovementioned, it is to be put into the veſſel deſigned for whitening, put over the roller, and a quantity of the liquid let into it. As the cloth whitens, the liquor gradually loſes its ſmell, and ſoon becomes incapable of giving any additional whiteneſs. This may be perceived by having a ſmall door in the ſide of the veſſel, which may be opened ocaſionally, and a bit of the cloth pulled out through it and looked at. When the firſt quantity of liquid, therefore, appears to have no more effect, it muſt be allowed to run off, into another veſſel; but is not yet to be thrown away, becauſe it is ſtill much more powerful than water, and will have a conſiderable effect upon cloths which have undergone the aqueous preparation.

After the firſt quantity of liquid is run off, another muſt be admitted from the lowermoſt reſervoir, and is to be uſed in the ſame manner with the former; only it will now be ſomewhat longer before its ſtrength is exhauſted. When this is the caſe, a third quantity is to be employed, and ſo on till we find that the effect of the liquid is beginning to diminiſh. The cloth muſt then be taken out, fulled, and thoroughly cleaned of the acid by water, before the next operation, which is boiling with alkali. The lixivium ought to be of conſiderable ſtrength, that the liquor may eaſily be evaporated, and part of the alkali recovered by a proceſs related under the article POTASHES; but as the cloth will neceſſarily retain a conſiderable quantity of this ſtrong lixivium, it muſt be wrung out by a proper inſtrument for that purpoſe, and the liquid which falls from it ſaved and returned again into the kettle. The cloth, ſtill retaining a quantity of alkali which could not be wrung out, muſt be thrown into a cauldron of boiling water, and allowed to remain there for a quarter of an hour; after which it is to be taken out and wrung as before. The water of the ſecond cauldron will be ſlightly alkaline, and may be uſed as a preparation for cloth, or for filling up the veſſel containing the ſtrong alkali as it evaporates.

Before the cloth is returned into the dephlogiſticated liquor, it is abſolutely neceſſary that the alkaline ſalt be entirely taken out of it, which can only be ſpeedily done by fulling, ſtreaming, or at leaſt ſteeping in repeated quantities of water. When all this is done, it will moſt probably be of a darker colour than before; but this will go off in a few minutes, and the cloth will become much whiter than ever. The remainder of the operation is only a repetition of the proceſſes already deſcribed, and for which no other directions are requiſite than that both alkali and acid, the latter eſpecially, always looſen a quantity of ſordes, which, unleſs waſhed off, ſoon prevents their own operation. As ſoon, therefore, as the cloth is taken out of either the alkaline, or acid liquor, there is a neceſſity for uſing every method conſiſtent with the ſafety of its texture to clear it of this looſe matter, which will allow the liquor into which it is next plunged to have the greater effect. It muſt be remembered, however, that the nearer the cloth approaches to perfect whiteneſs, the leſs effect has either of the liquids upon it; and therefore there is a neceſſity either for increaſing the ſtrength of the dephlogiſticated acid, or allowing it a longer time; but the latter is by much the preferable method: and, after all, it would be far from being improper to expoſe the cloth for a few days to the air, which will eſſentially prevent any change of colour afterwards, as frequently happens to cloths bleached after this manner.

Could a ready method be fallen upon to bleach flax by itſelf, it would be greatly in favour of the linen manufacture; as the ſtrength of the threads are vaſtly increaſed by this method. The great difficulty in this operation, ariſes from the filamentous nature of the flax: by which, when put into any liquid, it becomes matted together in ſuch a manner as not to be ſeparated afterwards by any means whatever ſo as to be ſpun with the ſame eaſe as before. The fairer and better dreſſed the lint is, the greater is this difficulty; and to obviate it, there ſeems to be no other poſſible method but that of uſing flax juſt as it comes from the mill, without any other dreſſing. Thus, indeed, the tow muſt be bleached as well as the flax: but when we conſider, that thus it may be ſpun into much finer and ſtronger yarn than otherwiſe could be done, we cannot ſuppoſe this to be any diſadvantage.

Another obſtacle is the difficulty the liquid has in getting into the heart of the flax; ſo that the outſide will be well whitened, when the inſide is ſcarce altered. For this no other remedy ſeems adequate, beſides the dividing it into many ſmall parcels, tying them together in pairs, putting them over rods as candle-makers do their candles, and thus ſuſpending them for a time in the liquid. They muſt be dipped in an hot ſolution of alkali in the ſame manner, afterwards for a conſiderable time in freſh water, to take out all the alkali; after which, they are to be again put into the acid liquor, and treated exactly as directed for the cloth. Thus, in two or three days, the flax will attain a ſurpriſing whiteneſs. It is then to be dreſſed and treated exactly as other flax, but muſt be dried without any kind of wringing or preſ-

ſure

ſure.—This method would appear to be uſeful, even though the utmoſt degree of whiteneſs ſhould not be given, as the texture of the threads will be much leſs injured by the ſubſequent bleaching than if the flax had been ſpun in its natural ſtate.

Mr Chaptal obſerves, that this acid may be applied to the whitening of paper and old prints; and by its means (he ſays) they obtain a whiteneſs which they never had before. Common ink diſappears by its action, but it has no effect upon printer's ink.—It thickens oils, and calcines metals to ſuch a degree, that the proceſs may be much expedited by its means. It diſſolves, metals without effervescence, and precipitates mercury from its ſolutions, converting it into corroſive ſublimate.—It acts, likewiſe, very vigorouſly upon metallic calces, forming with them ſalts more readily than other acids.

M. Chaptal obſerves, that the combination of the marine acid with vegetable alkali, named *febrifuge ſalt of Sylvius*, is found, though in ſmall quantities, in ſea-water, plaſter, and the aſhes of tobacco. "The exiſtence of this ſalt (ſays he) in the aſhes of tobacco, might with juſtice have ſurpriſed me, as I had reaſon to expect the muriate of ſoda, which is employed in the operation called *watering*. Was the ſoda metamorphoſed into pot-aſh by the vegetable fermentation? This may be determined by direct experiments."

MARINER, the ſame with a ſailor or ſeaman. See theſe articles.

Method of preſerving the health of MARINERS. See SEAMEN.

Mariner's Compaſs. See COMPASS.

ST MARINO, a ſmall town and republic of Italy, ſituated in E. Long. 13. 44. N. Lat. 44. 21. This ſmall republic conſiſts only of a mountain, and a few hillocks, that lie ſcattered about the bottom of it. The number of the inhabitants is about 5000. The mountain yields good wine, but they have no other than rain or ſnow water. The founder of the republic was a Dalmatian, and a maſon, who upwards of 1300 years ago turned hermit, and retired to this mountain. Here his devotion and auſterity, and, in conſequence of that, his reputation for ſanctity, were ſuch, that the princes of the country made him a preſent of the mountain; on which many, out of veneration for the ſaint, ſoon after took up their abode. Thus was the foundation laid of the town and republic, which ſtill bears the name of the ſaint. The town ſtands on the top of the mountain, and there is only one way by which it can be come at. In the whole territory are only three caſtles, three convents, and five churches. The largeſt of the churches is dedicated to the ſaint, and contains his aſhes and his ſtatue. He is looked upon as the greateſt ſaint, next to the bleſſed Virgin; and to ſpeak diſrepectfully of him is accounted blaſphemy, and puniſhed as ſuch. The republic is under the protection of the pope. All that are capable of bearing arms are exerciſed, and ready at a minute's call. In the ordinary courſe of government, the adminiſtration is in the hands of the council of 60, which, notwithſtanding its name, conſiſts only of 40; one half of the members of which are of the noble families, and the other of the plebeian: on extraordinary occaſions, however, the arengo, in which every houſe has its repreſentative, is called together. The two principal officers are the capitaneos, who are choſen every half year; and next to them is the commiſſary, who judges in civil and criminal matters, and is joined in commiſſary with the capitaneos; both he and the phyſician muſt be foreigners, and both have their ſalaries out of the public ſtock. When any perſon, after due ſummons, neglects to aſſiſt at the council according to their ſtatute-book, he is to be fined in about a penny Engliſh; and when an ambaſſador is to be ſent to any foreign ſtate, he is to be allowed about 1 s. a day.

MARINO (John Baptiſt), a celebrated Italian poet, born at Naples in 1569. His father, who was an able civilian, obliged him to ſtudy the law; at which being diſguſted, he left his parents, and retired to the houſe of the Sieur Manzi, who was a friend to all perſons of wit. He at length became ſecretary to Matthew of Capua, great admiral of the kingdom of Naples, and contracted a friendſhip with Taſſo. A ſhort time after, he went to Rome, and entered into the ſervice of cardinal Aldobrandini, nephew to pope Clement VIII. who took him with him to Savoy. Marino was in great favour with the court of Turin; but afterwards created himſelf many enemies there, the moſt furious of whom was the poet Gaſpard Murtola, who, attempting to ſhoot him with a piſtol, wounded one of the duke of Savoy's favourites. Marino being obliged to leave Turin, went to Paris at the deſire of queen Mary de Medicis, and publiſhed there his poem on Adonis. He afterwards went to Rome, where he was made prince of the academy of the humoriſti; from thence to Naples, where he died while he was preparing to return home. He had a very lively imagination, but little judgment; and, giving way to the points and conceits then in vogue, his authority, far from correcting the falſe taſte of the Italians, ſerved rather to keep it farther from reformation. His works, which are numerous, have been often printed.

MARINUS, an engraver who flouriſhed about the year 1630, and reſided principally at Antwerp. His plates, Mr Strutt obſerves, are executed in a very ſingular ſtyle, with the graver only: The ſtrokes are very fine and delicate, and croſſed over each other in a lozenge-like form, which he filled up with thin, long dots. His prints though generally very neat, want the ſtyle of the maſter in the determination of the folds of the draperies and the outline of the human figure; the extremities of which are heavy, and not marked with preciſion. Fine impreſſions from his beſt plates are, however, much ſought after by collectors; thoſe eſpecially after Rubens and Joardens are held in very high eſtimation.

MARIONIS, (anc. geog.) a town of Germany; now Hamburg, a famous trading city on the Elbe, in Lower Saxony, in the duchy of Holſtein. Another Marionis (Ptolemy), thought to be Wiſmar, a town of Lower Saxony, in the duchy of Mecklenburg.

MARIOTTE (Edme), an eminent phyſician and mathematician, was born in Burgundy, and was made a member of the academy of ſciences. He died in 1684. His works, which are much eſteemed, were printed at Leyden in 1717, 2 vols 4to.

MARJORAM, in botany. See ORIGANUM.

MARITAGIUM, in the feudal cuſtoms, *maritagium* (as contradiſtinguiſhed from *matrimonium*), ſignifies the power which the lord or guardian in chivalry had of diſpoſing of his infant ward in matrimony. For while the infant was in ward, the guardian had the power of tendering him or her a ſuitable match without diſparagement or inequality: which if the infants refuſed, they forfeited the value of the marriage, *valorem maritagii*, to their guardian; that is, ſo much as a jury would aſſeſs, or any one would *bona fide* give to the guardian for ſuch an alliance: and if the infants married themſelves without the guardian's conſent, they forfeited double the value, *duplicem valorem maritagii*.

MARITIME, ſomething relating to, or bounded by, the ſea. Thus a maritime province or country is one bounded by the ſea; and a maritime kingdom is one that makes a conſiderable figure, or that is very powerful at ſea. Hence, by *maritime* powers among the European ſtates, are underſtood great Britain and Holland.

MARITIME State, in Britiſh polity, one of the three general diviſions of the laity: (See LAITY). This ſtate is nearly connected with the military; though much more agreeable to the principles of a free conſtitution. The royal navy of England hath ever been its greateſt defence and ornament; it is its ancient and natural ſtrength; the floating bulwark of the iſland; an army from which, however ſtrong and powerful, no danger can ever be apprehended to liberty: and accordingly it has been aſſiduouſly cultivated from earlieſt ages. To ſo much perfection was their naval reputation arrived in the 12th century, that the code of maritime laws, which are called the *laws of Oleron*, and are received by all nations in Europe as the ground and ſubſtruction of all their marine conſtitutions, was confeſſedly compiled by king Richard I. at the iſle of Oleron on the coaſt of France, then part of the poſſeſſions of the crown of England. And yet ſo vaſtly inferior were their anceſtors in this point to the preſent age, that even in the maritime reign of queen Elizabeth, Sir Edward Coke thinks it matter of boaſt, that the royal navy of England then conſiſted of *three and thirty* ſhips. The preſent condition of their marine is in great meaſure owing to the ſalutary proviſions of the ſtatutes called the *navigation acts*; whereby the conſtant increaſe of Engliſh ſhipping and ſeamen was not only encouraged, but rendered unavoidably neceſſary. By the ſtatute 5 Richard II. c. 3. in order to augment the navy of England, then greatly diminiſhed, it was ordained, that none of the king's liege people ſhould ſhip any merchandize out of or into the realm, but only in ſhips of the king's ligeance, on pain of forfeiture. In the next year, by ſtatute 5 Ric. II. c. 8. this wiſe proviſion was enervated, by only obliging the merchants to give Engliſh ſhips (if able and ſufficient) the preference. But the moſt beneficial ſtatute for the trade and commerce of Britain is that navigation-act, the rudiments of which were firſt framed in 1650, with a narrow partial view; being intended to mortify their own ſugar iſlands, which were diſaffected to the parliament, and ſtill held out for Charles II. by ſtopping the gainful trade which they then carried on with the Dutch, and at the ſame time to clip the wings of thoſe their opulent and aſpiring neighbours. This prohibited all ſhips of foreign nations from trading with any Engliſh plantations, without licence from the council of ſtate. In 1651, the prohibition was extended alſo to the mother-country: and no goods were ſuffered to be imported into England, or any of its dependencies, in any other than Engliſh bottoms; or in the ſhips of that European nation of which the merchandize imported was the genuine growth or manufacture. At the Reſtoration, the former proviſions were continued, by ſtat. 12 Car. II. c. 18. with this very material improvement, that the maſter and three-fourths of the mariners ſhall alſo be Engliſh ſubjects.

Many laws have been made for the ſupply of the royal navy with ſeamen; for their regulation when on board; and to confer privileges and rewards on them during and after their ſervice.

1. For their ſupply. The principal, but the moſt odious, though often neceſſary method for this purpoſe, is by impreſſing; ſee IMPRESSING. But there are other ways that tend to the increaſe of ſeamen, and manning the royal navy. Pariſhes may bind out poor boys apprentices to the maſters of merchantmen, who ſhall be protected from impreſſing for the firſt three years; and if they are impreſſed afterwards, the maſters ſhall be allowed their wages; great advantages in point of wages are given to volunteer ſeamen, in order to induce them to enter into his majeſty's ſervice: and every foreign ſeaman, who during a war, ſhall ſerve two years in any man of war, merchantman, or privateer, is naturalized *ipſo facto*. About the middle of king William's reign, a ſcheme was ſet on foot for a regiſter of ſeamen to the number of 30,000, for a conſtant and regular ſupply of the king's fleet; with great privileges to the regiſtered men; and, on the other hand, heavy penalties in caſe of their non-appearance when called for; but this regiſtry, being judged to be rather a badge of ſlavery, was aboliſhed by ſtat. 9 Ann. c. 21.

2. The method of ordering ſeamen in the royal fleet, and keeping up a regular diſcipline there, is directed by certain expreſs rules, articles, and orders, firſt enacted by the authority of parliament ſoon after the Reſtoration; but ſince new-modelled and altered, after the peace of Aix-la-Chapelle, to remedy ſome defects which were of fatal conſequence in conducting the preceding war. In theſe articles of the navy almoſt every poſſible offence is ſet down, and the puniſhment thereof annexed: in which reſpect the ſeamen have much the advantage over their brethern in the land-ſervice; whoſe articles of war are not enacted by parliament, but framed from time to time at the pleaſure of the crown. Yet from whence this diſtinction aroſe, and why the executive power, which is limited ſo properly with regard to the navy, ſhould be ſo extenſive with regard to the army, it is hard to aſſign a reaſon; unleſs it proceeded from the perpetual eſtabliſhment of the navy, which rendered a permanent law for their regulation expedient, and the temporary duration of the army, which ſubſiſted only from year to year, and might therefore with leſs danger be ſubjected to diſcretionary government. But, whatever was apprehended at the firſt formation of the mutiny-act, the regular renewal of the ſtanding force at the

entrance of every year has made this diſtinction idle. For, if from experience paſt, we may judge of future events, the army is now laſtingly ingrafted into the Britiſh conſtitution; with this ſingularly fortunate circumſtance, that any branch of the legiſlature may annually put an end to its legal exiſtence, by refuſing to concur in its continuance.

3. With regard to the privileges conferred on ſailors, they are pretty much the ſame with thoſe conferred on ſoldiers, with regard to relief, when maimed, or wounded, or ſuperannuated, either by county-rates, or the royal hoſpital at Greenwich; with regard alſo to the exerciſe of trades, and the power of making nuncupative teſtaments: and, farther, no ſeaman aboard his majeſty's ſhips can be arreſted for any debt, unleſs the ſame be ſworn to amount to at leaſt twenty pounds; though, by the annual mutiny-acts, a ſoldier may be arreſted for a debt which extends to half that value, but not to a leſs amount.

MARIUS, the famous Roman general, and ſeven times conſul, who ſullied his great military reputation by ſavage barbarities. He was born at Arpinum, of obſcure and illiterate parents. He forſook the meaner occupations of the country for the camp; and ſignalized himſelf under Scipio, at the ſiege of Numantia. The Roman general ſaw the courage and intrepidity of young Marius, and foretold the æra of his future greatneſs. By his ſeditions and intrigues at Rome, while he exerciſed the inferior offices of the ſtate, he rendered himſelf known; and his marriage with Julia, who was of the family of the Cæſars, contributed in ſome manner to raiſe him to conſequence. He paſſed into Africa as lieutenant to the conſul Metellus againſt Jugurtha; and after he had there ingratiated himſelf with the ſoldiers, and raiſed enemies to his friend and benefactor, he returned to Rome and canvaſſed for the conſulſhip. The extravagant promiſes he made to the people, and his malevolent inſinuations about the conduct of Metellus, proved ſucceſsful. He was elected and appointed to finiſh the war againſt Jugurtha. He ſhowed himſelf capable in every degree to ſucceed to Metellus. Jugurtha was defeated, and afterwards betrayed into the hands of the Romans by the perfidy of Bocchus. No ſooner was Jugurtha conquered, than new honours and freſh trophies awaited Marius. The provinces of Rome were ſuddenly invaded by an army of 300,000 barbarians, and Marius was the only man whoſe activity and boldneſs could reſiſt ſo powerful an enemy. He was elected conſul, and ſent againſt the Teutones. The war was prolonged, and Marius was a third and fourth time inveſted with the conſulſhip. At laſt two engagements were fought, and not leſs than 200,000 of the barbarian forces of the Ambrones and Teutones were ſlain in the field of battle, and 90,000 made priſoners. The following year, A. U. C. 651, was alſo marked by a total overthrow of the Cimbri, another horde of barbarians; in which 140,060 were ſlaughtered by the Romans, and 60,000 taken priſoners. After ſuch honourable victories, Marius with his colleague Catullus entered Rome in triumph; and for his eminent ſervices he received the appellation of the *third founder of Rome.* He was elected conſul a ſixth time; and as his intrepidity had delivered his country from its foreign enemies, he ſought employment at home, and his reſtleſs ambition began to raiſe ſeditions, and to oppoſe the power of Sylla. This was the foundation of a civil war. Sylla refuſed to deliver up the command of his forces, with which he was empowered to proſecute the Mithridatic war; and he reſolved to oppoſe in perſon the authors of a demand which he conſidered as arbitrary and improper. He advanced to Rome, and Marius was obliged to ſave his life by flight. The unfavourable winds prevented him from ſeeking a ſafer retreat in Africa, and he was left on the coaſt of Campania, where the emiſſaries of his enemy ſoon diſcovered him in a marſh, where he had plunged himſelf in the mud, and left only his mouth above the ſurface for reſpiration. He was violently dragged to the neighbouring town of Minturnæ; and the magiſtrates, all devoted to the intereſt of Sylla, paſſed ſentence of immediate death on their magnanimous priſoner. A Gaul was commanded to cut off his head in the dungeon; but the ſtern countenance of Marius diſarmed the courage of the executioner: and when he heard the exclamation of *Tune, homo, audes occidere Caium Marium,* the dagger dropped from his hand. Such an uncommon adventure moved the compaſſion of the inhabitants of Minturnæ. They releaſed Marius from priſon; and favoured his eſcape to Africa, where he joined his ſon Marius, who had been arming the princes of that country in his cauſe. Marius landed near the walls of Carthage, and he received no ſmall conſolation at the ſight of the venerable ruins of a once powerful city, which like himſelf had been expoſed to calamity, and felt the cruel viciſſitude of fortune. This place of his retreat was ſoon known; and the governor of Africa, to conciliate the favour of Sylla, compelled Marius to fly to a neighbouring iſland. He ſoon after learned that Cinna had embraced his cauſe at Rome, when the Roman ſenate had ſtripped him of his conſular dignity, and beſtowed it upon one of his enemies. This intelligence animated Marius; he ſet ſail to aſſiſt his friend only at the head of 1000 men. His army, however, was ſoon increaſed, and he entered Rome like a conqueror. His enemies were inhumanly ſacrificed to his fury; Rome was filled with blood; and he, who once had been called the father of his country, marched through the ſtreets of the city, attended by a number of aſſaſſins, who immediately ſlaughtered all thoſe whoſe ſalutations were not anſwered by their leader. Such were the ſignals for bloodſhed. When Marius and Cinna had ſufficiently gratified their reſentment, they made themſelves conſuls; but Marius, already worn out with old age and infirmities, died ſixteen days after he had been honoured with the conſular dignity for the ſeventh time, A. U. C. 666. Such was the end of Marius, who rendered himſelf conſpicuous by his victories and by his cruelty. As he was brought up in poverty and among peaſants, it will not appear wonderful that he always betrayed ruſticity in his behaviour, and deſpiſed in others thoſe poliſhed manners and that ſtudied addreſs which education had denied him. He hated the converſation of the learned only becauſe he was illiterate; and if he appeared an example of ſobriety and temperance, he owed theſe advantages to the years of obſcurity which he paſſed at Arpinum. His countenance was ſtern, his voice firm and imperious, and his diſpoſition untractable. He was in the 70th year of his age when he died; and Rome ſeemed to rejoice at the fall of a man whoſe ambition had proved ſo fatal to many of her citizens. His only qualifications were thoſe of a great general; and with theſe he rendered himſelf the moſt illuſtrious and powerful of the Romans, becauſe he was the only one whoſe ferocity ſeemed capable to oppoſe the barbarians of the north.

C. **Marius**, the ſon of the great Marius, was as cruel as his father, and ſhared his good and his adverſe fortune. He made himſelf conſul in the 12th year of his age, and murdered all the ſenators who oppoſed his ambitious views. He was defeated by Sylla, and fled to Præneſte, where he killed himſelf.

Marius (M. Aurelius), a native of Gaul; who, from the mean employment of a blackſmith, became one of the Generals of Gallienus, and at laſt cauſed himſelf to be ſaluted emperor. Three days after this elevation, a man who had ſhared his poverty without partaking of his more proſperous fortune, publicly aſſaſſinated him, and he was killed by a ſword which he himſelf had made in the time of his obſcurity. Marius has been often celebrated for his great ſtrength; and it is confidently reported, that he could ſtop, with one of his fingers only, the wheel of a chariot in its moſt rapid courſe.

Marius (Maximus), a Latin writer, who publiſhed an account of the Roman emperors from Trajan to Alexander, now loſt. His compoſitions were entertaining, and executed with great exactneſs and fidelity. Some have accuſed him of inattention, and complain that his writings abounded with many fabulous and inſignificant ſtories.

MARIVAUX (Peter Carlet de), a French writer in the dramatic way and in romance, was born of a good family at Paris in 1688. A fine underſtanding, well improved by education, diſtinguiſhed him early. His firſt object was the theatre, where he met with the higheſt ſucceſs in comic productions; and theſe, with the merit of his other works, procured him a place in the French academy. The great characteriſtic of both his comedies and romance was, to convey an uſeful moral under the veil of wit and ſentiment: "My only object (ſays he) is to make men more juſt and more humane;" and he was as amiable in his life and converſation as he was in his writings. He died at Paris in *1763, aged 75. His works conſiſt of, 1. *Pieces de Theatre*, 4 vols 12mo. 2. *Homere traveſti*, 12mo; which is not ſuppoſed to have done much honour to his taſte. 3. *Le Spectateur François*, 2 vols 12mo. 4. *De Philoſophie Indegent*, 12mo. 5. *Vie de Marianne*, 2 vols 12mo; one of the beſt romances in the French language. 6. *Le Payſan Parvenu*, 12. 7. *Pharſamon*; inferior to the former.

MARK (St.) was by birth a Jew, and deſcended of the tribe of Levi. He was converted by ſome of the apoſtles, probably by St Peter; to whom he was a conſtant companion in all his travels, ſupplying the place of an amanuenſis and interpreter. He was by St Peter ſent into Egypt, fixing his chief reſidence at Alexandria, and the places thereabout: where he was ſo ſucceſsful in his miniſtry, that he converted multitudes both of men and women. He afterwards removed weſtward, towards the parts of Libya, going through the countries of Marmorica, Pentapolis, and others thereabouts; where, notwithſtanding the barbarity and idolatry of the inhabitants, he planted the goſpel. Upon his return to Alexandria, he ordered the affairs of that church, and there ſuffered martyrdom in the following manner. About Eaſter, at the time the ſolemnities of Serapis were celebrated, the idolatrous people, being excited to vindicate the honour of their deity, broke in upon St Mark, while he was performing divine ſervice, and, binding him with cords, dragged him through the ſtreets, and thruſt him into priſon, where in the night he had the comfort of a divine viſion. Next day the enraged multitude uſed him in the ſame manner, till, his ſpirits failing, he expired under their hands. Some add, that they burnt his body, and that the Chriſtians decently interred his bones and aſhes near the place where he uſed to preach. This happened in the year of Chriſt 68. Some writers aſſert, that the remains of St Mark were afterwards, with great pomp, tranſlated from Alexandria to Venice. However, he is the tutelar ſaint and patron of that republic, and has a very rich and ſtately church erected to his memory. This apoſtle is author of one of the four goſpels inſcribed with his name. See the following article.

St **Mark**'*s Goſpel*, a canonical book of the New Teſtament, being one of the four goſpels.

St Mark wrote his goſpel at Rome, where he accompanied St Peter in the year of Chriſt 44. Tertullian and others pretend, that St Mark was no more than an amanuenſis to St Peter, who dictated this goſpel to him; others affirm, that he wrote it after St Peter's death. Nor are the learned leſs divided as to the language it was wrote in; ſome affirming that it was compoſed in Greek, others in Latin. Several of the ancient heretics received only the goſpel of St Mark: others, among the Catholics, rejected the 12 laſt verſes of this goſpel. The goſpel of St Mark is properly an abridgement of that of St Matthew.

St **Mark** *the Evangeliſt's Day*, a feſtival of the Chriſtian church, obſerved April 25.

Canons of St **Mark**, a congregation of regular canons founded at Mantua, by Albert Spinola a prieſt, towards the end of the 12th century. Spinola made a rule for them, which was approved, corrected, and confirmed by ſeveral ſucceeding popes. About the year 1450 they were reformed, and followed only the rule of St Auguſtine. This congregation having flouriſhed by the ſpace of 400 years, declined by little and little, and is now become extinct.

Knights of St **Mark**, an order of knighthood in the republic of Venice, under the protection of St Mark the evangeliſt. The arms of the order are, gules, a lion winged or; with this device, Pax tibi Marce Evangelista. This order is never conferred but on thoſe who have done ſignal ſervice to the commonwealth.

Mark, or *Marc*, in commerce, denotes a weight uſed in ſeveral ſtates of Europe, and for ſeveral commodities, eſpecially gold and ſilver. In France, the mark is divided into eight ounces, 64 drachms, 192 derniers or penny-weights, 160 eſterlines, 300 mailis, 640 felins, or 4608 grains. In Holland, the mark weight is alſo ſo called *Troy-weight*, and is equal to that of France. When gold and ſilver are ſold by the mark, it is divided into 25 carats.

Mark is alſo uſed in Britain for a money of account, and in ſome other countries for a coin. See *Money-Table*.

The Engliſh mark is two thirds of a pound Sterling, or 13s. 4d. and the Scots mark is of equal value in Scots money of account, viz. 13⅓d.

MARKET, a public place in a city or town, in which live-cattle, proviſions, or other goods, are ſet to ſale; and alſo a privilege, either by grant or preſcription, by which a town is enabled to keep a market.

Court of the Clerk of the Market, in England, is incident to every fair and market in the kingdom, to puniſh miſdemeanors therein; and a court of *piepoudre* is to determine all diſputes relating to private or civil property. The object of this juriſdiction (ſee ſtat. 17. Car. II. cap. 19. 22 Car. II. cap. 8. 23 Car. II. cap. 12.) is principally the cognizance of weights and meaſures, to try whether they be according to the true ſtandard thereof or no: which ſtandard was anciently committed to the cuſtody of the biſhop, who appointed ſome clerk under him to inſpect the abuſe of them more narrowly; and hence this officer, though uſually a layman, is called the clerk of the market.—If they be not according to the ſtandard, then, beſide the puniſhment of the party by fine, the weights and meaſures themſelves ought to be burnt. This is the loweſt court of criminal juriſdiction in England.

MARKHAM (Gervaſe), an Engliſh author, was the ſon of Robert Markham of Gotham, Eſq; in Nottinghamſhire, and bore a captain's commiſſion under Charles I. in the civil wars. He was eſteemed both a good ſoldier and a good ſcholar. He was particularly maſter of the French, Italian, and Spaniſh. He wrote, 1. The tragedy of Herod and Antipater, which was printed in 1622. 2. Many volumes upon huſbandry and horſemanſhip. 3. A piece on the art of fowling. 4. The ſoldiers accidence and grammar.

MARKLAND (Jeremiah), one of the moſt learned ſcholars and penetrating critics of the age, was born in 1692, and received his education in Chriſt's hoſpital. He became firſt publicly known by his *Epiſtola Critica*, addreſſed to biſhop Hare. In this he gave many proofs of extenſive erudition and critical ſagacity. He afterwards publiſhed an edition of Statius, and ſome plays of Euripides; and aſſiſted Dr Taylor in his editions of Lyſias and Demoſthenes, by the notes which he communicated to him. He has alſo very happily elucidated ſome paſſages in the New Teſtament, which may be found in Boyer's edition of it; and was author of a very valuable volume of remarks on the epiſtles of Cicero to Brutus, and of an excellent little treatiſe under the title of *Quæſtio Grammatica*. He died in 1775, at Milton, near Dorking in Surry; and was a man not more valued for his univerſal reading than beloved for the excellency of his heart and primitive ſimplicity of manners.

MARLBOROUGH, a town of Wiltſhire in England, ſituated near the ſource of the Kennet, at the foot of a chalky hill, 75 miles from London. It has its name from its chalky ſoil, which was formerly called *marle*. It was a Roman ſtation. In the year 1627, a parliament was held in the caſtle here, which made thoſe laws called *Marlborough ſtatutes*. There are ſtill ſome ſmall remains of its walls and ditch. The town, which is an ancient borough by preſcription, ſends two members to parliament. It is governed by a mayor, 2 juſtices, 12 aldermen, 24 burgeſſes, a town-clerk, 2 bailiffs, 12 ſerjeants at mace, &c. It conſiſts chiefly of one broad ſtreet, with piazzas all along one ſide of it, two pariſh-churches, and ſeveral commodious inns, it being the grand thoroughfare from London to Bath and Briſtol. To the ſouth are ſome relicts of a priory, particularly the Gate-houſe; and the ſcite of a Roman Caſtrum, the foundations of which have been diſcovered there, with Roman coins. The ditch is ſtill in ſome parts 20 feet wide; and towards the river, without the garden walls, one angle of the Caſtrum is very viſible with the rampart and ditch entire. The mount at the weſt end of the town, which was the keep or main-guard of the caſtle, is converted into a pretty ſpiral walk; at the top of which is an octagon ſummer-houſe. This town has often ſuffered by fire, particularly in 1690, whereupon the parliament paſſed an act to prevent its houſes from being thatched. The markets here are Wedneſdays and Saturdays; and it has five fairs. Here is a charity-ſchool, which was erected in 1712, for 44 children.

Marlborough (duke of). See Churchill.

Marlborough-Fort, an Engliſh factory on the weſt coaſt of the iſland of Samatra in Aſia; ſeated three miles weſt of the town of Bencoolen. E. Long. 101. 12. S. Lat. 4. 21.

MARLE, a kind of calcareous earth, very much uſed in agriculture as a manure. See Agriculture nº 216, 217.

Marle is dug in many places of Great Britain and Ireland. In digging for it in Ireland, they meet with horns and other curious foſſils. The marle always lies in the bottoms of low bogs, and is found by boring with augres made for that purpoſe. It uſually lies at five, ſeven, or nine feet depth. The obtaining it in many places is attended with very conſiderable expence in draining off the water. The manner of digging it is this: They employ ſix able labourers and a ſupernumerary; and theſe cut up a hole of 12 feet ſquare, which is ſuppoſed a pit that this number of men can manage in one day. Two men dig, two throw it up, and two throw it by, and the ſupernumerary man ſupplies defects on all occaſions. For the firſt three feet they dig through a fuzzy earth, fit for making turf or fuel. Under this lies a ſtratum of gravel of about half a foot; under this often, for three feet more, there is a more kindly moſs, which would make better fuel. This lower ſtratum is always full of foſſile wood, which is uſually ſo ſoft that the ſpade cuts as eaſily through it as through the earth it lies in. Under this, for the thickneſs of about three inches is found a ſeries of leaves, principally of the oak. Theſe appear very fair to the eye, but fall to pieces on being touched; and this ſtratum is ſometimes interrupted by vaſt heaps of ſeed, which ſeem to be broom or furze ſeed. In ſome places there appear berries of different kinds, and in others ſeveral ſpecies of ſea-plants; all lying in the ſame confuſed manner as the oak leaves. Under this vegetable ſtratum there lies one of blue clay, half a foot thick, and uſually full of ſea ſhells. This blue clay is not ſo tough as common clay; but is thrown carefully up, and uſed as marle in ſome places. Under this always appears the true marle; the ſtratum of which is uſually from two to four feet thick, and ſometimes much more.—This marle looks like buried lime, and is full of ſhells, which are uſually of a ſmall ſize, and of the periwinkle kind; but there are ſeveral other ſorts at times found among them. Among this marle, and often at the very bottom of it, are found great numbers of very large horns of the deer kind, which are vulgarly called *elk's horns*. Theſe, where they join to the head, are thick and round; and at that joining there grows out a branch, which is about a foot long, and ſeems to have hung juſt over the creatures eyes: it grows ſtill round for about a foot above this; and then ſpreads out abroad, and terminates in branches long and round, terminating with a ſmall bend. The labourers are obliged to work in a hurry in all theſe pits, ſo that they ſeldom bring out the horns whole. There are alſo, at times, found the leg-bones and other parts of the ſkeletons of the ſame beaſts; but this more rarely, only a few together, and but in few places.

Dr Black is of opinion, that all kinds of marle derive their origin from the calcareous matter of ſhells and lithophyta.

Shell-marle, ſays he, is compoſed of the ſhells of aquatic animals, which are ſometimes very entire, and often decayed or mixed down with other earthy ſubſtances. Examining this matter as occurring in different places, it may be diſtinguiſhed into freſh water marle, and the marle of ſea-ſhells. Of the firſt we have an example in the Meadow at Edinburgh. Wherever the ſoil is turned up to the depth of ſix inches, a quantity appears. It is compoſed of the ſhells of a ſmall freſh-water ſnail or welk. This animal, when alive, is not eaſily diſcernible, the ſhell being much of the ſame obſcure colour as the ſtones covered with the water. But we can obſerve a great number of them in all running brooks and other collections of freſh water; and as the animal dies, the ſhells are depoſited where the water ſtagnates in very great quantity. That compoſed of ſea-ſhells, conſtitutes greater collections that are found in innumerable places now far removed, from the ſea. That moſt particularly deſcribed by Reaumur is a collection of this kind in the province of France, and at Turpin. That part of the country where it is found is computed to contain 80 ſquare miles of ſurface; and whenever they dig to a certain depth, they find this collection of ſhells: the country at preſent is 108 miles from the ſea. They find the marle eight or nine feet below the ſurface, and they dig it to the depth of 20 feet. It is ſtill deeper, but they find it too expenſive to ſearch for it. He ſuppoſes it to be only 18 feet deep; and even at this depth the quantity will appear enormous. It will amount to 140 millions of cubic fathoms of ſhells that are moſtly decayed and broken into fragments, and mixed with other marine productions, as millipores, madripores, and other coralline bodies, which are all productions of the ſea.

MARLINE, in ſea affairs, are tarred white ſkains, or long wreaths or lines of untwiſted hemp, dipped in pitch or tar, with which cables or other ropes are wrapped round, to prevent their fretting or rubbing in the blocks or pullies through which they paſs. The ſame ſerves in artillery upon ropes uſed for rigging gins, uſually put up in ſmall parcels called *ſkains*.

MARLOE (Chriſtopher), an Engliſh dramatic author, was a ſtudent in the univerſity of Cambridge; but afterwards turning player, he trod the ſame ſtage with the inimitable Shakeſpeare. He was accounted an excellent poet even by Ben Johnſon himſelf. He wrote ſix tragedies, one of which called *Luſt's Dominion*, or the *Laſcivious Queen*, has been altered by Mrs Behn, and acted under the title of *Abdelazer*, or the *Moor's Revenge*. Some time before his death, he had made a conſiderable progreſs is an excellent poem entitled *Hero* and *Leander*; which was afterwards finiſhed by George Chapman, who is ſaid to have fallen ſhort of the ſpirit and invention diſcovered by Marloe. Mr Anthony Wood repreſents him as a free thinker, in the worſt ſenſe of the word; and gives the following account of his death. Falling deeply in love with a low girl, and having for his rival a fellow in livery, Marloe, imagined that his miſtreſs granted him favours, was fired with jealouſy, and ruſhed upon him in order to ſtab him with his dagger; but the footman avoided the ſtroke, and, ſeizing his wriſt, ſtabbed him with his own weapon; of which wound he died, in the year 1593.

MARLOW, a town of Buckinghamſhire, in England, 31 miles from London, lies under the Chiltern Hill, in a marly ſoil. It is a pretty large borough, though not incorporated, with a bridge over the Thames, not far from its conflux with Wycomb, and has a handſome church and town-hall, with a charity-ſchool for 20 boys, who are taught and clothed. It firſt ſent members to Parliament, in the reign of Edward II. Bone lace is its chief manufacture. The Thames brings goods hither from the neighbouring towns, eſpecially great quantities of meal and malt from High-Wycomb, and beech from ſeveral parts of the county, which abounds with this wood more than any in England. In the neighbourhood are frequent horſe-races; and here are ſeveral corn and paper mills, particularly on the river Loddon, between this town and High-Wycomb. There are, beſides, the Temple-mills, for making thimbles, and another for preſſing oil from rape and flax ſeeds. Its market is on Saturdays, and fair October 29.

MARLY, a palace belonging to the kings of France, between Verſailles and St Germain; ſeated in a valley, near a village and foreſt of the ſame name. It is noted for its fine gardens and water-works, there being a curious machine on the river Seine, which not only ſupplies them with water, but alſo thoſe of Verſailles. It is 10 miles N. W. of Paris. E. Long. 2. 11. N. Lat. 48. 52.

MARMANDE, a town of France, in Guienne, and in Agennois. It carries on a great trade in corn and wine; and is ſeated on the river Garonne, in E. Long. 0. 15. N. Lat. 38. 35.

MARMALADE, a confection of plums, apricots, quinces, &c. boiled up to a conſiſtence with ſugar. In

Scot-

Scotland, it is made of Seville oranges and ſugar only.

MARMOR. See Marble.

MARMORA, the name of four iſlands of Aſia, in the ſea of the ſame name. The largeſt is about 30 miles in circumference; and the ſoil of them all produces corn, wine, and fruits. The ſea of Marmora is a large gulph, which communicates both with the Archipelago and the Black Sea by that of Conſtantinople, being 120 miles in length and 50 in breadth; and all ſhips muſt paſs through it that ſail to Conſtantinople from the Mediterranean. It was anciently the *Propontis*.

MARMORICA, a country of Africa anciently inhabited by the Libyans. It was bounded on the eaſt by Egypt, on the weſt by Cyrenaica, on the ſouth by Sahara, or the deſart of Libya Interior, and on the north by the Mediterranean; and was reckoned a part of Egypt. There is no diſtinct hiſtory of the country.

MAROBUDUM (anc. geog.), the royal reſidence of Marobuduus, king of the Marcomanni; and hence the appellation. Now thought to be *Prague*, the capital of Bohemia.

MAROLLES (Michel de), born in 1600, was the ſon of Claude de Marolles, whom French memoirs make a military hero. Michel, however, was of a different compoſition. He entered early into the eccleſiaſtical ſtate, and by the intereſt of his father obtained two abbeys. He was formed with an extreme ardour for ſtudy, which never abated all his life long: for, from 1619 when he publiſhed a tranſlation of Lucan, to 1681 the year of his death, he was conſtantly employed in writing and printing. He attached himſelf unfortunately to the tranſlating of ancient Latin writers: but, being devoid of all claſſical taſte and ſpirit, they ſunk miſerably under his hands, the poets eſpecially. He was certainly, however, a man of great learning, and diſcovered all his life a love for the arts. He was one of the firſt who paid any attention to prints; and collected about 100,000, which make at this day one of the ornaments of the French king's cabinet. He compoſed memoirs of his own life, which were publiſhed by the Abbé Goujet, 1755, in 3 vols. They contain, like ſuch ſort of things, ſome intereſting facts, but an infinity of minute and inſipid nothings.

MARONITES, in eccleſiaſtical hiſtory, a ſect of eaſtern Chriſtians, who follow the Syrian rite, and are ſubject to the pope; their principal habitation being on mount Libanus.

Moſheim informs us, that the doctrine of the Monothelites, condemned and exploded by the council of Conſtantinople, found a place of refuge among the Mardaites, a people who inhabited the mounts Libanus and Antilibanus, and who, about the concluſion of the ſeventh century, were called *Maronites*, after *Maro* their firſt biſhop; a name which they ſtill retain. None (he ſays) of the ancient writers give any certain account of the firſt perſon who inſtructed theſe mountaineers in the doctrine of the Monothelites: it is probable, however, from ſeveral circumſtances, that it was John Maro, whoſe name they had adopted; and that this eccleſiaſtic received the name of Maro from his having lived in the character of a monk in the famous convent of St Maro, upon the borders of the Orontes, before his ſettlement among the Mardaites of mount Libanus. One thing is certain, from the teſtimony of Tyrius and other unexceptionable witneſſes, as alſo from the moſt authentic records, viz. that the Maronites retained the opinions of the Monothelites until the 12th century, when, abandoning and renouncing the doctrine of one will in Chriſt, they were readmitted in the year 1182 to the communion of the Roman church. The moſt learned of the modern Maronites have left no method unemployed to defend their church againſt this accuſation; they have laboured to prove, by a variety of teſtimonies, that their anceſtors always perſevered in the Catholic faith, in their attachment to the Roman pontiff, without ever adopting the doctrine of the Monophyſites, or Monothelites. But all their efforts are inſufficient to prove the truth of theſe aſſertions to ſuch as have any acquaintance with the hiſtory of the church and the records of ancient times; for to all ſuch the teſtimonies they allege will appear abſolutely fictitious and deſtitute of authority.

Fauſtus Nairon, a Maronite who ſettled at Rome, has publiſhed an apology for Maron and the reſt of his nation. His tenet is, that they really took their name from the Maron, who lived about the year 400, and of whom mention is made in Chryſoſtom, Theodoret, and the Menologium of the Greeks. He adds, that the diſciples of this Maron ſpread themſelves throughout all Syria; that they built ſeveral monaſteries, and, among others, one that bore the name of their leader; that all the Syyrians who were not tainted with hereſy took refuge among them; and that for this reaſon the heretics of thoſe times called them Maronites.

Moſheim obſerves, that the ſubjection of the Maronites to the ſpiritual juriſdiction of the Roman pontiff was agreed to with this expreſs condition, that neither the popes nor their emiſſaries ſhould pretend to change or aboliſh any thing that related to the ancient rites, moral precepts, or religious opinions, of this people: ſo that in reality there is nothing to be found among the Maronites that ſavours of popery, if we except their attachment to the Roman pontiff, who is obliged to pay very dear for their friendſhip. For, as the Maronites live in the utmoſt diſtreſs of poverty, under the tyrannical yoke of the Mahometans, the biſhop of Rome is under the neceſſity of furniſhing them with ſuch ſubſidies as may appeaſe their oppreſſors, procure a ſubſiſtence for their biſhop and clergy, provide all things requiſite for the ſupport of their churches, and the uninterrupted exerciſe of public worſhip, and contribute in general to leſſen their miſery. It is certain that there are Maronites in Syria who ſtill behold the church of Rome with the greateſt averſion and abhorrence; nay, what is ſtill more remarkable, great numbers of that nation reſiding in Italy, even under the eye of the pontiff, oppoſed his authority during the laſt century, and threw the court of Rome into great perplexity. One body of theſe non-conforming Maronites retired into the valleys of Piedmont, where they joined the Waldenſes; another, above 600 in number, with a biſhop and ſeveral eccleſiaſtics at their head, fled into Corſica, and implored the protection of the republic of Genoa againſt the violence of the inquiſitors.

The Maronites have a patriarch, who reſides in the monaſtery of Cannubin, on mount Libanus, and aſſumes the title of patriarch of Antioch, and the name of Peter, as if he ſeemed deſirous of being conſidered as the ſucceſſor of that apoſtle. He is elected by the clergy and the people, according to the ancient cuſtom; but, ſince their reunion with the church of Rome, he is obliged to have a bull of confirmation from the pope. He keeps a perpetual celibacy, as well as the reſt of the biſhops his ſuffragans: as to the reſt of the eccleſiaſtics, they are allowed to marry before ordination; and yet the monaſtic life is in great eſteem among them. Their monks are of the order of St Antony, and live in the moſt obſcure places in the mountains, far from the commerce of the world.

As to their faith, they agree in the main with the reſt of the eaſtern church. Their prieſts do not ſay maſs ſingly; but all ſay it together, ſtanding round the altar. They communicate in unleavened bread; and the laity have hitherto partaken in both kinds, though the practice of communicating in one has of late been getting footing, having been introduced by little and little. In Lent they eat nothing, unleſs it be two or three hours before ſun-riſing: their other faſtings are very numerous.

To MAROON, to put one or more ſailors aſhore upon a deſolate iſland, under pretence of their having committed ſome great crime. This deteſtable expedient has been repeatedly practiſed by ſome inhuman commanders of merchant-ſhips, particularly in the Weſt Indies.

MAROT (Clement), the beſt French poet of his time, was born at Cahors in 1495; and was the ſon of John Marot, valet de chambre to Francis I. and poet to queen Anne of Brittany. He enjoyed his father's place of valet de chambre to Francis I. and was page to Margaret of France wife to the duke of Alençon. In 1521 he followed that prince into Italy, and was wounded and taken priſoner at the battle of Pavia; but at his return to Paris was accuſed of hereſy, and thrown into priſon, from whence he was delivered by the protection of king Francis I. He at length retired to the queen of Navarre, then to the ducheſs of Ferrara, and in 1536 returned to Paris: but declaring openly for the Calviniſts, he was obliged to fly to Geneva; which he at length left, and retiring to Piedmont, died at Turin in 1544, aged 50. His verſes are agreeably filled with natural beauties. La Fontaine acknowledged himſelf his diſciple, and contributed greatly to reſtore to vogue the works of this ancient poet. Marot, beſides his other works, has tranſlated part of the Pſalms into verſe, which was continued by Beza, and are ſtill ſung in the proteſtant churches abroad.—*Michael Marot*, his ſon, was alſo the author of ſome verſes; but they are not comparable to thoſe of *John*, and much leſs to thoſe of *Clement Marot*.—The works of the three *Marots* were collected and printed together at the Hague in 1731, and 3 vols 4to, and in 6 vols 12mo.

MARPURG, a ſtrong and conſiderable town of Germany, in the Upper Rhine, and in the landgravate of Heſſe-Caſſel, with an univerſity, a caſtle, a palace, a handſome ſquare, and a magnificent town-houſe. It is ſeated on the river Lohn, in a pleaſant country, 15 miles ſouth of Waldeck, and 47 ſouth-weſt of Caſſel. E. Long. 8. 53. N. Lat. 50. 42.

Marpurg, a handſome town of Germany, in Lower Styria, ſeated on the river Drave, 25 miles ſouth-weſt of Gratz, and 60 north-eaſt of Laubach. E. Long. 16. 10. N. Lat. 46. 42.

MARQUARD (Frehar), an eminent German civilian, born at Augſburg in 1565. He ſtudied at Bourges, under the learned Cujas; and acquired great ſkill in polite literature, and in the laws. At his return to Germany, he became counſellor to the elector Palatine, and profeſſor of law at Heidelberg; and was afterwards ſent by the elector Frederic IV. as his miniſter, into Poland, to Mentz, and ſeveral other courts. He died at Heidelberg in 1614. He wrote many works which are eſteemed; the principal of which are, 1. *De re monetaria veterum Romanorum, et hodierni apud Germanos imperii.* 2. *Rerum Bohemicarum ſcriptores.* 3. *Rerum Germanicarum ſcriptores.* 4. *Corpus hiſtoriæ Franciæ*, &c.

MARQUE, or *Letters of Marque*, in military affairs, are letters of repriſal, granting the ſubjects of one prince or ſtate liberty to make repriſals on thoſe of another.—They are ſo called from the German *marcke*, "limit, frontier;" as being *jus conceſſum in alterius principis marckas ſeu limites tranſeundi, ſibique jus faciendi;* as being a right of paſſing the limits or frontiers of another prince, and doing one's ſelf juſtice.

Letters of marque are extraordinary commiſſions granted by authority for reparation to merchants taken and deſpoiled by ſtrangers at ſea; and repriſals is only the retaking, or taking of one thing for another*. The form in theſe caſes in Britain is, the ſufferer muſt firſt apply to the lord privy-ſeal, and he ſhall make out letters of requeſt under the privy-ſeal; and if, after ſuch requeſt of ſatisfaction made, the party required do not, within convenient time, make due ſatiſfaction or reſtitution to the party grieved, the lord chancellor ſhall make him out letters of marque under the great ſeal; and by virtue of theſe he may attack and ſeize the property of the aggreſſor nation, without hazard of being condemned as a robber or pirate.

MARQUESAS-islands, the name of certain iſlands in the South Sea, lying between 8 and 10 degrees of ſouth latitude, and between 139 and 140 degrees of weſt longitude. They are five in number, viz. La Magdalena, St Pedro, La Dominica, Santa Chriſtina, and Hood Iſland. All the natives of theſe iſlands may be ſuppoſed to be of the ſame tribe. Thoſe ſpots that are fit for culture are very populous; but as every iſland is very mountainous, and has many inacceſſible and barren rocks, it is to be doubted whether the whole population of this group amounts to 50,000 perſons. The Spaniards, who firſt viſited here, found the manners of this people gentle and inoffenſive; but theſe qualities did not prevent thoſe who landed from wantonly butchering ſeveral of the natives at Magdalena.

The inhabitants of theſe iſlands collectively, ſays Captain Cook, are, without exception, the fineſt race of people in the South Sea. For ſymmetry of ſhape, and regular features, they perhaps ſurpaſs all other nations. Not a ſingle deformed or ill-proportioned perſon was ſeen on the iſland; all were ſtrong, tall, well-limbed, and remarkably active. The men are about

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* See *Prerogative.*

five feet ſix to ten inches high; their teeth are not ſo good, nor are their eyes ſo full and lively, as thoſe of many other nations: their hair is of many colours, but none red; ſome have it long, but the moſt general cuſtom is to wear it ſhort, except a bunch on each ſide the crown, which they tie in a knot; their countenances are pleaſing, open, and full of vivacity: they are of a tawny complexion, which is rendered almoſt black by punctures over the whole body. They were entirely naked, except a ſmall piece of cloth around their waiſt and loins. The punctures were diſpoſed with the utmoſt regularity, ſo that the marks on each leg, arm, and cheek, were exactly ſimilar. The women, in two days time, began to appear in conſiderable numbers, and the ſailors found them not leſs kind than thoſe of the other iſlands which they had viſited; they were inferior to the men in ſtature, but well proportioned: their general colour was brown: no punctures were obſerved upon them: they wore a ſingle piece of cloth made of the mulberry bark, which covered them from the ſhoulders to the knees.

The principal head-dreſs uſed in the iſlands, and what appear to be their chief ornament, is a ſort of broad fillet, curiouſly made of the fibres of the huſks of cocoa-nuts; in the front is fixed a mother-of-pearl ſhell, wrought round to the ſize of a tea-ſaucer; before that another ſmaller, of very fine tortoiſe-ſhell, perforated into curious figures; alſo before, and in the centre of that is another round piece of mother-of-pearl, about the ſize of half a crown; and before this another piece of perforated tortoiſe-ſhell, the ſize of a ſhilling. Beſides this decoration in front, ſome have it alſo on each ſide, but in ſmall pieces; and all have fixed to them the tail-feathers of cocks, or tropic-birds, which when the fillet is tied on ſtand upright, ſo that the whole together makes a very ſprightly ornament. They wear round the neck a kind of ruff or necklace made of light wood, the outward and upper ſides covered with ſmall peaſe, which are fixed on with gum; they alſo wear ſome bunches of human hair faſtened to a ſtring, and tied round the legs and arms. But all the above ornaments are ſeldom ſeen on the ſame perſon. All theſe ornaments, except the laſt, they freely parted with for a trifling conſideration; but the human hair they valued very highly, though theſe bunches were the uſual reſidence of many vermin. It is probable, that theſe were worn in remembrance of their deceaſed relations, and therefore were looked upon with ſome veneration; or they may be the ſpoils of their enemies, worn as the honourable teſtimonies of victory. However, a large nail, or ſomething which ſtruck their eyes, commonly got the better of their ſcruples. The king, or chief of the iſland, came to viſit captain Cook; he was the only one ſeen completely dreſſed in this manner. Their ordinary ornaments are necklaces, and amulets made of ſhells, &c. All of them have their ears pierced, though none were ſeen with ear-rings. The king had not much reſpect paid him by his attendants: he preſented Captain Cook with ſome fruit and hogs; and acquainted him that his name was *Honoo*, and that he was *he-ka-ai* which title ſeems to correſpond with the *aree* of Otaheitee, and *arekee* of the Friendly iſles. Their dwellings are in the valleys, and on the ſides of the hills near their plantations. They are built in the ſame manner as thoſe at Otaheitee, which will be particularly deſcribed when we ſpeak of that iſland; but they are much meaner, and are only covered with the leaves of the bread fruit tree; in general, they are built on a ſquare or oblong pavement of ſtone. raiſed ſome height above the level of the ground; they likewiſe have ſuch pavement near their houſes, on which they ſit to eat and amuſe themſelves. Along the uppermoſt edge of the mountain a row of ſtakes or palliſadoes, cloſely connected together, were ſeen like a fortification, in which, by the help of glaſſes, appeared ſomething like huts which ſeemed to bear a great reſemblance to the hippas, of New-Zealand, which will be deſcribed in ſpeaking of that country. Their canoes reſemble thoſe of Otaheitee, but not ſo large; their heads had commonly ſome flat upright piece, on which the human face was coarſely carved; and their ſails were made of mats, triangular in ſhape, and very broad at the top: the paddles which they uſed were of heavy hard wood; ſhort, but ſharp-pointed, and with a knob at the upper end; they were from 10 to 20 feet long, and about 15 inches broad.

Their weapons were all made of the club-wood, or caſuarina; and were either plain ſpears about 8 or 10 feet long, or clubs which commonly had a knob at one end. They have alſo ſlings with which they throw ſtones with great velocity, and to a great diſtance, but not with a good aim.

The language of theſe people is much nearer to that of Otaheitee than any other dialect in the South-Sea, except that they could not pronounce the letter *r*.

The only quadrupeds ſeen here were hogs, except rats; here were fowls, and ſeveral ſmall birds in the woods, whoſe notes were very melodious. The chief difference between the inhabitants of the Marqueſas and thoſe of the Society iſlands ſeems to conſiſt in their different degrees of cleanlineſs: the former do not bathe two or three times a-day, nor waſh their hands and face before and after every meal, as the latter do, and they are beſides very ſlovenly in the manner of preparing their meals. Their diet is chiefly vegetable; though they have dogs and fowls, and catch abundance of fiſh at certain times. Their drink is pure water, cocoa-nuts being ſcarce here.

It was not long before the propenſity of the natives was diſcovered to be rather to receive than give; for when they had taken a nail as the price of a bread-fruit, the article ſo purchaſed could not be obtained from them. To remove this diſhoneſt diſpoſition, Captain Cook ordered a muſket to be fired over their heads, which terrified them into fair dealing.

Soon after the natives had gathered courage enough to venture on board the ſhip, one of them unfortunately ſtole an iron ſtanchion from the gang-way, with which he ſprang into the ſea, and, notwithſtanding its weight, ſwam with it to his canoe, and was making to the ſhore with all ſpeed. A muſket was fired over his head to frighten him back, but to no effect, he ſtill continued to make off with his booty; the whiſtling of another ball over his head was as ineffectual: an officer, leſs patient of ſuch an injury than reaſon and humanity ſhould have taught him to be, levelled a muſket at the poor fellow, and ſhot him thro' the head. Captain Cook had given orders to fire over the canoe, but not to kill any one; he was in a boat, and came up with the canoe ſoon after. There were two men in her: one ſat bailing out the blood and water in a kind of hyſteric laugh; the other, a youth of about 14 or 15 years of age, who afterwards proved to be the ſon of the deceaſed, fixed his eyes on the dead body with a ſerious and dejected countenance. This act of ſeverity, however, did not eſtrange the iſlanders to the ſhip, and a traffic was carried on to the ſatisfaction of both parties; bread-fruit, bananas, plantains, and ſome hogs, were given in exchange for ſmall nails, knives, and pieces of Amſterdam cloth; red feathers of the Amſterdam-Iſland were greatly eſteemed here. Captain Cook, accompanied with the gentlemen of the ſhip, in their walks about the country, lighted on the houſe which had been the habitation of the man who had been ſhot; there they found his ſon who fled at their approach: they enquired for his female relations, and were told that they remained at the top of the mountain, to weep and mourn for the dead. Notwithſtanding they were then among the relations of a man who had been killed by them, not the leaſt tokens of animoſity or revenge were diſcernable among the natives.

The weather being extremely hot, the inhabitants made uſe of large fans to cool themſelves, of which great numbers were purchaſed; theſe fans were formed of a kind of tough bark, or graſs, very firmly and curiouſly plaited, and frequently whitened with ſhell lime. Some had large feathered leaves of a kind of palm, which anſwered the purpoſe of an umbrella.

The natives at length became ſo familiar as to mount the ſides of the ſhip in great numbers. They frequently danced upon deck for the diverſion of the ſailors: their dances very much reſembled thoſe of Otaheitee; their muſic too was very much the ſame.

A ſailor having been inattentive to his duty, received ſeveral blows from Captain Cook; on ſeeing which, the natives exclaimed, *tape-a hei-te tina*, "he beats his brother." From other inſtances that had occurred, it was clear that they knew the difference between the commander and his people, but at the ſame time they conceived them all brethren; and, ſays Mr Foſter, "to me the moſt natural inference is, that they only applied an idea to us in this caſe, which really exiſted with regard to themſelves; they probably look on themſelves as one family, of which the eldeſt born is the chief or king."

MARQUETRY, IN-LAID WORK; a curious kind of work, compoſed of pieces of hard fine wood of different colours, faſtened, in thin ſlices, on a ground, and ſometimes enriched with other matters, as tortoiſe ſhell, ivory, tin, and braſs.

There is another kind of marquetry made, inſtead of wood, of glaſſes of various colours; and a third, where nothing but precious ſtones and the richeſt marbles are uſed: but theſe are more properly called *Moſaic-work*. See MOSAIC.

The art of inlaying is very ancient; and is ſuppoſed to have paſſed from the eaſt to the weſt, as one of the ſpoils brought by the Romans from Aſia. Indeed it was then but a ſimple thing; nor did it arrive at any tolerable perfection till the 15th century among the Italians: it ſeems, however, to have arrived at its height in the 17th century among the French.

Till John of Verona, a cotemporary with Raphael, the fineſt works of this kind were only black and white, which are what we now call *Moreſco's*; but that religious, who had a genius for painting, ſtained his woods with dyes or boiled oils, which penetrated them. But he went no farther than the repreſenting buildings and perſpectives, which require no great variety of colours. Thoſe who ſucceeded him, not only improved on the invention of dyeing the woods, by a ſecret which they found of burning them without conſuming, which ſerved exceedingly well for the ſhadows, but had alſo the advantage of a number of fine new woods of naturally bright colours, by the diſcovery of America. With theſe aſſiſtances the art is now capable of imitating any thing; whence ſome call it the *art of painting in wood*.

The ground whereon the pieces are to be ranged and glued, is ordinarily of oak or fir well dried; and to prevent warping, is compoſed of ſeveral pieces glued together. The wood to be uſed, being reduced into leaves, of the thickneſs of a line, is either ſtained with ſome colour, or made black for ſhadow; which ſome effect by putting it in ſand extremely heated over the fire, others by ſteeping it in lime-water and ſublimate, and others in oil of ſulphur.—Thus coloured, the contours of the piece are formed according to the parts of the deſign they are to repreſent.

The laſt is the moſt difficult part of marquetry, and that wherein moſt patience and attention are required. The two chief inſtruments uſed herein are the ſaw and the vice: the one, to hold the matters to be formed; the other, to take off from the extremes, according to occaſion. The vice is of wood, having one of its chaps fixed; the other moveable, and is opened and ſhut by the foot, by means of a cord faſtened to a treadle. Its ſtructure is very ingenious, yet ſimple enough.

The leaves to be formed (for there are frequently three or four of the ſame kind formed together) are put within the chaps of the vice, after being glued on the outermoſt part of the deſign whoſe profile they are to follow; then the workmen preſſing the treadle, and thus holding faſt the piece, with his ſaw runs over all the outlines of the deſign.—By thus joining and forming three or four pieces together, they not only gain time, but the matter is likewiſe the better enabled to ſuſtain the efforts of the ſaw; which, how delicate ſoever it may be, and how lightly ſoever the workman may conduct it, without ſuch a precaution would be apt to raiſe ſplinters, to the ruin of the beauty of the work.

When the work is to conſiſt of one ſingle kind of wood, or of tortoiſe-ſhell, on a copper or tin ground, or *vice verſa*, they only form two leaves on one another, *i. e.* a leaf of metal, and a leaf of wood or ſhell: this they call *ſawing in counter-parts*; for by filling the vacuities of one of the leaves by the pieces coming out to the other, the metal may ſerve as a ground to the wood, and the wood to the metal,

All the pieces thus formed with the ſaw and marked to know them again, and the ſhadow given in the manner already mentioned; they vaneer or faſten each in its place on the common ground; uſing for that purpoſe the beſt Engliſh glue.

The whole is put into a preſs to dry, planed over, and poliſhed with the ſkin of the ſea-dog, wax, and ſhave-graſs, as in ſimple vaneering, with this difference, however, that in marquetry the fine branches, and ſeveral of the more delicate parts of the figures, are touched up and finiſhed with a graver.

It is the cabinet-makers, joiners, and toy-men among us who work in marquetry; it is the enamellers and ſtone-cutters who deal in moſaic-work: the inſtruments uſed in the former are moſtly the ſame with thoſe uſed by the eboniſts.

MARQUIS, a title of honour, next in dignity to that of duke. His office is to guard the frontiers and limits of the kingdom, which were called the *marches*, from the Teutonic word *marche*, a "limit:" as, in particular, were the marches of Wales and Scotland, while they continued hoſtile to England. The perſons who had command there, were called *lords marchers*, or *marquiſſes*; whoſe authority was aboliſhed by ſtatute 27 Hen. VIII. c. 27. though the title had long before been made a mere deſign of honour, Robert Vere earl of Oxford being created marquis of Dublin by Richard II. in the eighth year of his reign. A marquis is created by patent; his mantle is double ermine. three doublings and an half; his title is *moſt honourable;* and his coronet has pearls and ſtrawberry-leaves intermixed round, of equal height.

MARR, that part of Aberdeenſhire in Scotland, ſituated between the river Dee and Don.

MARRACCI (Lewis), a very learned Italian, was born at Lucca in Tuſcany in 1612. After having finiſhed his juvenile ſtudies, he entered into the congregation of regular clerks of the mother of God, and diſtinguiſhed himſelf early by his learning and merit. He taught rhetoric ſeven years, and paſſed thro' ſeveral offices of his order. He applied himſelf principally to the ſtudy of languages, and attained of himſelf the knowledge of the Greek, the Hebrew, the Syriac, the Chaldee, the Arabic; which at laſt he taught ſome time at Rome, by the order of pope Alexander VII. Pope Innocent XI. choſe him for his confeſſor, and placed great confidence in him. He would have advanced him to eccleſiaſtical dignities, if Marracci had not oppoſed him.—Marracci died at Rome in 1700, aged 87.—He was the author of ſeveral pieces in Italian; but the grand work, which has made him deſervedly famous all over Europe, is his edition of the Alkoran, in the original Arabic, with a Latin verſion, notes, and confutation of his own. It was beautifully printed in 2 vols folio at Padua in 1698. The Latin verſion of the Alkoran, by Marracci, with notes and obſervations from him and others, and a ſynopſis of the Mahometan religion, by way of introduction, was publiſhed by Heineccius at Leipſic 1721, in 8vo. Marracci had alſo a hand in the "Biblia ſacra Arabica, ſacræ congregationis de propaganda fide juſſu edita, ad uſum eccleſiarum orientalium," *Romæ* 1671, in 3 vols folio.

MARRIAGE, a contract, both civil and religious, between a man and a woman, by which they engage to live together in mutual love and friendſhip for the ends of procreation, &c. See MORAL *Philoſophy*.

Marriage is a part of the law of nations, and is in uſe among all people. The Romaniſts account it a ſacrament.—The woman, with all her moveable goods, immediately upon marriage, paſſes wholly *in poteſtatem viri*, "into the power and diſpoſal of the huſband."

The firſt inhabitants of Greece lived together without marriage. Cecrops, king of Athens, is ſaid to have been the firſt author of this honourable inſtitution among that people. After the commonwealths of Greece were ſettled, marriage was very much encouraged by their laws, and the abſtaining from it was diſcountenanced and in many places puniſhed. The Lacedemonians were very remarkable for their ſeverity towards thoſe who deferred marriage beyond a limited time, as well as to thoſe who wholly abſtained from it. The Athenians had an expreſs law, that all commanders, orators, and perſons intruſted with any public affair, ſhould be married men. Polygamy was not commonly tolerated in Greece. The time of marriage was not the ſame in all places. The Spartans were not permitted to marry till they arrived at their full ſtrength, the reaſon aſſigned for which cuſtom by Lycurgus was, that the Spartan children might be ſtrong and vigorous: and the Athenian laws are ſaid to have once ordered, that men ſhould not marry til 35 years of age. The ſeaſons of the year which they preferred for this purpoſe was the winter, and particularly the month of January, called *Gamelion*. The Greeks thought it ſcandalous to contract marriage within certain degrees of conſanguinity; whilſt moſt of the barbarous nations allowed inceſtuous mixtures.

Moſt of the Grecian ſtates, eſpecially ſuch as made any figure, required their citizens ſhould match with none but citizens, and the children were not allowed to marry without the conſent of their parents. The uſual ceremonies in promiſing fidelity was kiſſing each other, or giving their right hands, which was a general form of ratifying all agreements. Before the marriage could be ſolemnized, the gods were to be conſulted, and their aſſiſtance implored by prayers and ſacrifices, which were offered to ſome of the deities that ſuperintended theſe affairs, by the parents or neareſt relations of the perſons to be married. When the victim was opened, the gall was taken out and thrown behind the altar, as being the ſeat of anger and malice, and therefore the averſion of all the deities who had the care of love, as well as thoſe who became their votaries. For the particulars relating to the bride and bridegroom, ſee BRIDE and BRIDEGROOM.

The Romans, as well as the Greeks diſallowed of polygamy. A Roman might not marry any woman who was not a Roman. Among the Romans, the kalends, nones, and ides of every month were deemed unlucky for the celebration of marriage, as was alſo the feaſt of the *parentalia*, and the whole month of May. The moſt happy ſeaſon in every reſpect was that which followed the ides of June.

The Roman law ſpeaks of ſecond mariages in very hard and odious terms; *Matre jam ſecundis nuptiis funeſtata*, L. iii. C. de ſec. nuptiis. By theſe laws it was enacted, that the effects of the huſband or wife deceaſed ſhould paſs over to the children, if the ſurvivor ſhould marry a ſecond time. By the law *Hac*

edictali

edictali (Cod. de ſec. nupt.), the ſurvivor, upon marrying a ſecond time, could not give the perſon he married a portion more than equal to that of each the children. In the primitive church the reſpect to chaſtity was carried ſo high, that a ſecond marriage was accounted no other than a lawful whoredom, or a ſpecies of bigamy; and there are ſome ancient canons which forbid the eccleſiaſtics from being preſent at ſecond marriages.

Marriage, by the Moſaic law, was ſubject to ſeveral reſtrictions; thus by Levit, chap. xviii. ver. 16. a man was forbid to marry his brother's widow unleſs he died without iſſue; in which caſe it became enjoined as a duty. So it was forbid to marry his wife's ſiſter, while ſhe was living, ver. 18.; which was not forbidden before the law, as appears from the inſtance of Jacob.

The ancient Roman law is ſilent of this head; and Papinian is the firſt who mentions it, on occaſion of the marriage of Caracalla. The lawyers who came after him ſtretched the bonds of affinity ſo far, that they placed adoption on the ſame foot with nature.

Affinity, according to the modern canoniſts, renders marriage unlawful to the fourth generation, incluſive; but this is to be underſtood of direct affinity, and not of that which is ſecondary or collateral. *Affinis mei affinis, non eſt affinis meus*. It is farther to be obſerved, that this impediment of marriage does not only follow an affinity contracted by lawful matrimony, but alſo that contracted by a criminal commerce; with this difference, that this laſt does not extend beyond the ſecond generation; whereas the other, as has been obſerved, reaches to the fourth.

In Germany they have a kind of marriage called *marganatic*, wherein a man of quality contracting with a woman of inferior rank, he gives her the left hand in lieu of the right; and ſtipulates in the contract that the wife ſhall continue in her former rank or condition; and that the children born of them ſhall be of the ſame, ſo that they become baſtards as to matters of inheritance, though they are legitimate in effect. They cannot bear the name or arms of the family. None but princes and great lords of Germany are allowed this kind of marriage. The univerſities of Leipſic and Jena have declared againſt the validity of ſuch contracts; maintaining that they cannot prejudice the children, eſpecially when the emperor's conſent intervenes in the marriage.

The Turks have three kinds of marriages, and three ſorts of wives; *legitimate*, *wives in kebin*, and *ſlaves*. They marry the firſt, hire the ſecond, and buy the third.

Among all the ſavage nations, whether in Aſia, Africa, or America, the wife is commonly bought by the huſband from her father or thoſe other relations who have an authority over her; and the concluſion of a bargain for this purpoſe, together with the payment of the price, has therefore become the uſual form or ſolemnity in the celebration of their marriages. The Hebrews alſo purchaſed their wives by paying down a competent dowry for them; and Ariſtotle makes it one argument to prove that the ancient Grecians were an uncivilzed people, becauſe they uſed to buy their wives; and in proportion as they laid aſide their barbarous manners they left off this practice.

The Engliſh law conſiders marriage in no other light than as a civil contract; the holineſs of the matrimonial ſtate being left entirely to the eccleſiaſtical law, to which it pertains, to puniſh or annul inceſtuous or other unſcriptural marriages. The law allows marriage to be good and valid, where the parties at the time of making it were willing and able to contract, and actually did contract; in the proper forms and ſolemnities required by law. The diſabilities for contracting are of two ſorts: firſt ſuch as are canonical, and therefore ſufficient by the eccleſiaſtical laws to void the marriage in the ſpiritual court; ſuch as pre-contract, conſanguinity, or relation by blood; and affinity, or relation by marriage, and ſome particular corporal infirmities. But theſe diſabilities in law do not make the marriage *ipſo facto* void, but voidable only by ſentence of ſeparation; and marriages are eſteemed valid to all civil purpoſes, unleſs ſuch ſeparation is actually made during the life of the parties. Thus when a man had married his firſt wife's ſiſter, and after her death the biſhop's court was proceeding to annul the marriage and baſtardiſe the iſſue, the court of king's bench granted a prohibition *quoad hoc;* but permitted them to proceed to puniſh the huſband for inceſt.

By 32 Hen. VIII. c. 38. it is declared that all perſons may lawfully marry but ſuch as are prohibited by God's law, &c. And that nothing (God's law excepted) ſhall impeach any marriage but within the Levitical degrees: theſe are enumerated in the 18th chapter of Leviticus, and are illuſtrated by Lord Coke in this manner: a man may not marry his mother, father's ſiſter, mother's ſiſter, ſiſter, daughter, daughter of her ſon or daughter, father's wife, uncle's wife, father's wife's daughter, brother's wife, wife's ſiſter ſon's wife or wife's daughter, and daughter of his wife's ſon or daughter. And a woman muſt not marry her father, father's brother, mother's brother, brothers ſon, ſon of her huſband's ſon or daughter, mother's huſband, aunt's huſband, ſiſter's huſband, huſband's brother, and ſon of her huſband's ſon or daughter. By the civil law firſt couſins are allowed to marry; but by the canon law both firſt and ſecond couſins are prohibited. Therefore when it is vulgarly ſaid that firſt couſins may marry but ſecond couſins cannot, this probably aroſe by confounding theſe two laws; for firſt couſins may marry by the civil law, and ſecond couſins cannot by the canon law. But by the foreſaid ſtat. 32 Hen. VIII. c. 38. it is clear, that both firſt and ſecond couſins may marry. By the ſame ſtatute all impediments ariſing from pre-contracts to other perſons were aboliſhed, and declared of none effect unleſs they have been conſummated with bodily knowledge; in which caſe the canon law holds ſuch contract to be a marriage *de facto*. But this branch of the ſtatute was repealed by 2 & 3 Ed. VI. c. 23. How far the act of 26 Geo II. c. 33. (which prohibits all ſuits in eccleſiaſtical courts to compel a marriage in conſequence of any contract) may collaterally extend to revive this clauſe of Henry VIII.'s ſtatute, and aboliſh the impediment of pre-contract, judge Blackſtone leaves to be conſidered by the canoniſts. We ſhall here obſerve, that on a promiſe of marriage, if it be mutual on both ſides, damages may be recovered in caſe either party refuſes to marry; and tho' no time for the marriage is agreed on, if the plaintiff avers that he offered to marry the defendant who refuſed it, an action is maintainable for the damages; but no action ſhall be brought upon any agreement except it is in writing, and ſigned by the party to be charged. The canonical hours for celebrating marriage are from 8 to 12 in the forenoon.

The other ſort of diſabilities are thoſe which are created, or at leaſt enforced, by the municipal laws. Theſe civil diſabilities make the contract void *ab initio* by rendering the parties incapable of forming any contract at all. The firſt legal diſability is a prior marriage, or having another huſband or wife living; in which caſe, beſides the penalties conſequent upon it as a felony, the ſecond marriage is to all intents and purpoſes void. See BIGAMY and POLYGAMY.

The next legal diſability is want of age: therefore if a boy under 14, or a girl under 12 years of age, marries when either of them comes to the age of conſent, they may diſagree and declare the marriage void without any divorce or ſentence in the ſpiritual court. However, in Engliſh law it is ſo far a marriage, that if at the age of conſent they agree to continue together, they need not be married again. Another incapacity ariſes from want of conſent of parents or guardians. By ſeveral ſtatutes, viz. 6 & 7 W. III. c. 6. 7. 8. W. III. c. 35. 10. Ann. c. 19. penalties of 100 l. are laid on every clergyman who marries a couple either without publication of banns, which may give notice to parents or guardians, or without a licence, to obtain which the conſent of parents or guardians muſt be ſworn to. And by 4 & 5 Ph. & M. c. 1. whoſoever marries any woman child under the age of 16 years, without conſent of parents or guardians, ſhall be ſubject to fine or five years impriſonment; and her eſtate during her huſband's life ſhall be enjoyed by the next heir. Thus alſo in France the ſons cannot marry without conſent of parents till 30 years of age, nor the daughters till 25; and in Holland the ſons are at their own diſpoſal at 25, and the daughters at 20. And by the marriage act, viz. 26 Geo. II. c. 33. it is enacted, that all marriages celebrated by licence (for banns ſuppoſe notice), where either of the parties is under 21, not being a widow or widower, without the conſent of the father, or if he be not living, of the mother or guardians, ſhall be abſolutely void. However, proviſion is made where the mother or guardian is non compos, beyond ſea, or unreaſonably froward, to diſpenſe with ſuch conſent at the diſcretion of the lord chancellor; but no proviſion is made in caſe the father ſhould labour under any mental or other incapacity. A fourth incapacity is want of reaſon. It is provided by 15 Geo. II. c. 30. that the marrige of lunatics and ſons under phrenſies (if found lunatics under a commiſſion or committed to the care of truſtees by an act of parliament) before they are declared of ſound mind by the lord chancellor, or the majority of ſuch truſtees, ſhall be totally void. Laſtly, the parties muſt not only be willing and able to contract, but muſt actually contract themſelves in due form of law to make a good civil marriage. Any contract made *per verba de præſenti*, or in words of the preſent tenſe, and in caſe of cohabitation *per verba de futuro* alſo between perſons able to contract, was before the late act deemed a valid marriage to many purpoſes, and the parties might be compelled in the ſpiritual courts to celebrate it *in facie eccleſiæ*. But theſe verbal contracts are now of no force to compel a future marriage. Nor is any marriage at preſent valid that is not celebrated in ſome pariſh church, or public chapel, unleſs by diſpenſation from the archbiſhop of Canterbury. It muſt alſo be preceded by publication of banns or by licence from the ſpiritual judge. A marriage in purſuance of banns muſt be ſolemnized in one of the churches or chapels where the banns were publiſhed. No parſon, vicar, &c. ſhall be obliged to publiſh banns of matrimony, unleſs the perſons to be married ſhall ſeven days before the time required for the firſt publication, deliver to him a notice in writing in their true names, and of the houſe or houſes of their reſpective abode within ſuch pariſh, &c. and of the time that they have dwelt in ſuch houſe or houſes. And the ſaid banns ſhall be publiſhed upon three Sundays preceding the ſolemnization of marriage during the time of public ſervice: in caſe the parents or guardians or either of the parties who ſhall be under the age of 21 years, ſhall openly and publicly declare, or cauſe to be declared in the church or chapel where the banns ſhall be ſo publiſhed, at the time of ſuch publication, their diſſent to ſuch marriage, ſuch publication of banns ſhall be void. And when the parties dwell in divers pariſhes, the curate of the one pariſh ſhall not ſolemnize matrimony betwixt them without a certificate of the banns being thrice aſked from the curate of the other pariſh. A marriage in purſuance of a licence (except a ſpecial licence) muſt be ſolemnized in ſuch church or chapel where the licence is granted: and no licence of marriage ſhall be granted by any archbiſhop, biſhop, &c. to ſolemnize any marriage in any other church, &c. than in the pariſh church, &c. within which the uſual place of abode of one of the parties ſhall have been for four weeks immediately before the granting ſuch licence. By the ſame ſtatute all marriages ſhall be ſolemnized in the preſence of two credible witneſſes at the leaſt, beſides the miniſter, who ſhall ſign their atteſtation thereof; and immediately after the celebration of every marriage, an entry thereof ſhall be made in the pariſh-regiſter, expreſſing that the ſaid marriage was celebrated by banns or licence; and if both or either of the parties be under age, with conſent of the parents or guardians, as the caſe ſhall be, ſigned by the miniſter, and alſo by the parties married, and atteſted by the two witneſſes preſent. It is held to be alſo eſſential to a marriage, that it be performed by a perſon in orders; though the intervention of a prieſt to ſolemnize this contract is merely *juris poſitivi*, and not *juris naturalis aut divini*; it being ſaid that Pope Innocent III. was the firſt who ordained the celebration of marriage in the church, before which it was totally a civil contract. And in the times of the grand rebellion, all marriages were performed by the juſtices of the peace; and theſe marriages were declared valid without any freſh ſolemnization, by 12 Car. II. c. 33. But as the law now ſtands, we may upon the whole collect, that no marriage by the temporal law is *ipſo facto* void that is celebrated by a perſon in orders; in a pariſh church, a public chapel, or elſewhere, by a ſpecial diſpenſation; in purſuance of banns or a licence; between ſingle perſons; conſenting; of ſound mind, and the age of 21 years; or of the age of 14 in males and 12 in females, with conſent of parents or guardians, or without it, in caſe of widowhood. And no marriage is voidable by the eccleſiaſtical law after the death of either of the parties; nor during their lives, unleſs for the canonical impediments of precontract, if that indeed ſtill exiſts, of conſanguinity; and of affinity or corporal imbecility ſubſiſting previous to the marriage.

By 26 Geo. II. c. 33. the ſubſtance of which has been already recited, if any perſon ſhall ſolemnize matrimony in any other place than a church, &c. where banns have been uſually publiſhed, unleſs by ſpecial licence, or without publication of banns, unleſs licence of marriage be firſt obtained from ſome perſon having authority to grant the ſame, every ſuch perſon knowingly ſo offending ſhall be guilty of felony, and tranſported for 14 years; the proſecution to be within three years. By the ſame ſtatute, to make a falſe entry into a marriage regiſter; to alter it when made; to forge or counterfeit ſuch entry, or a marriage licence, or aid and abet ſuch forgery; touttter the ſame as true, knowing it to be a counterfeit; or to deſtroy or procure the deſtruction of any regiſter in order to vacate any marriage, or ſubject any perſon to the penalties of this act; all theſe offences, knowingly and wilfully committed, ſubject the party to the guilt of felony without benefit of clergy. But this act doth not extend to the marriages of the royal family; nor to Scotland; nor to any marriages among the people called *quakers*, or among perſons profeſſing the Jewiſh religion, where both the parties are quakers or Jews reſpctively; nor to any marriages beyond the ſeas.

In Scotland, the parties living together as man and wife, or declaring themſelves ſo before witneſſes, makes a valid though informal marrage. See Law, Part III. n° 160.

For the proportions which marriages bear to births, and births to burials, in ſeveral parts of Europe, Mr Derham gives us the following table.

Names of Places.	Marriages to Births, as	Births to Burials, as
England in general	1 to 4.63	1. 12 to 1
London	1 to 4	1. to 1. 1
Hantſhire, from 1569 to 1658	1 to 4	1. 2 to 1
Tiverton in Devonſhire from 1656 to 1664	1 to 3.7	1. 26 to 1
Cranbrook in Kent, from 1560 to 1649	1 to 3.9	1. 6 to 1
Anyho, in Northamptonſhire, for 118 years	1 to 6	1. 6 to 1
Upminſter in Eſſex, for 100 years	1 to 4. 6	1. 8 to 1
Franckfort on the Maine, in 1695	1 to 3. 7	1. 2 to 1
Old, Middle, and Lower Marck, in 1698	1 to 3. 7	1. 9 to 1
Dominions of the Elector of Brandenburg, in 1698	1 to 3. 7	1. 5 to 1
Breſlaw in Sileſia, from 1687 to 91	——	1. 6 to 1
Paris, in 1670, 1671, 1672	1 to 4.7	1. 6 to 1

The following Table, ſimilar to the preceding, is formed from the obſervations collected and referred to by Dr Price.

Chambers's Cyclopædia, by Dr Rees

Names of Places.	Marriages to Births, as	Births to Burials, as
London, annual medium from 1716 to 1736	— — —	18,000 to 26,529, or 1 to 1.4, &c.
———————from 1759 to 1768	— — —	15.710 to 22,956, or 1 to 1.4, &c.
Northampton, ditto, from 1741 to 1770	— — —	155 to 191, or 1 to 1.2, &c.
Norwich, ditto, from 1740 to 1769	— — —	1057 to 1206, or 1 to 1.1, &c.
Shrewſbury, ditto, from 1762 to 1768	— — —	301 to 329, or 1 to 1.09, &c.
Mancheſter and Salford, excluſive of diſſenters,		
Ditto, from 1755 to 1759	— — —	756 to 743,————
Ditto, ditto, including diſſenters, from 1768 to 1772	— — —	1098 to 958, or 1.14, &c. to 1.
Gainſborough in Lincolnſhire, ditto, from 1752 to 1771	1 to 3.7	126 to 105, or 1.2 to 1.
Madeira, ditto, from 1759 to 1766	1 to 4.68	2201 to 1293, or 1.7 to 1.
Boſton in New England, from 1731 to 1752	— — —	538 to 608, or 1 to 1.13, &c.
Chriſtiana in Norway, in 1761	— — —	11,024 to 6929, or 1.5 to 1.
Paris, mean of ſome of the laſt years	1 to 4.3	19,100 to 19,400, or 1 to 1.01, &c.
Vienna, annual medium from 1757 to 1769	— — —	5800 to 6600, or 1 to 1.1, &c.
Amſterdam, ditto, for ſome of the laſt years	1 to 1.9, &c.	4600 to 8000, or 1 to 1.7, &c.
Copenhagen, ditto	1 to 3.04, &c.	2700 to 3300 or 1 to 1.2, &c.
Berlin, ditto, for five years, ending at 1759	1 to 3. 9, &.	3855 to 5054, or 1 to 1.3, &c.
Breſlaw, ditto, from 1633 to 1734	— — —	1089 to 1256, or 1 to 1.15, &c.
———, ditto, from 1717 to 1725	— — —	1252 to 1507, or 1 to 1.2, &c.
Rome, ditto from 1759 to 1761	— — —	5167 to 7153, or 1 to 1.3, &c.
Vaud in Switzerland, ditto, for 10 years before 1766	1 to 3.9	3155 to 2504, or 1.2, &c. to 1.

For an account of the numbers of males and female ſtill-born children and chryſoms, and of boys and girls under ten, of married men and married women, and of widows and widowers, who died for a courſe of years at Vienna, Breſlaw, Dreſden, Leipſic, Ratiſbon, and ſome other towns in Germany, ſee Phil. Tranſ. Abr. Vol. VII. Part IV. p. 36, &c.

Chalm. Cyclop. Dr Rees.

The reader may find many curious calculations and remarks relating to this ſubject in Dr Price's excellent work, intitled, Obſervations on Reverſionary Payments. From the preceding table it appears, that marriages, one with another, do each produce about four births, both in England and other parts of Europe. Dr Price obſerves, that the births at Paris, as may be ſeen in the table, are above four times the weddings; and therefore it may ſeem, that in the moſt healthy country ſituations, every wedding produces above four children; and though this be the caſe in Paris, for reaſons which he has given, he has obſerved nothing like it in any other great town. He adds, that from comparing the births and weddings in countries and towns where regiſters of them have been kept, it appears, that in the former, marriages one with another ſeldom produce leſs than four children each; generally between four and five, and ſometimes above five; but in towns ſeldom above four, generally between three and four, and ſometimes under three. It is neceſſary to be obſerved here, that though the proportion of annual births to weddings has been conſidered as giving the true number of children derived from each marriage, taking all marriages one with another; yet this is only true, when, for many years, the births and burials have kept nearly equal. Where there is an exceſs of the births occaſioning an increaſe, the proportion of annual births to weddings muſt be leſs than the proportion of children derived from each marriage: and the contrary muſt take place where there is a decreaſe: and by Mr King's computation, about one in an hundred and four perſons marry; the number of people in England being eſtimated at five millions and a half; whereof about forty-one thouſand annually marry.

In the diſtrict of Vaud in Switzerland, the married are very nearly a third part of the inhabitants.

Major Graunt and Mr King diſagree in the proportions between males and females, the latter making 10 males to 13 females in London; in other cities and towns, and in the villages and hamlets, 100 males to 99 females: but Major Graunt, both from the London and country bills, computes, that there are in England 14 males to 13 females; whence he juſtly infers, that the Chriſtian religion, prohibiting polygamy, is more agreeable to the law of nature than Mahometaniſm and others that allow it.

This proportion of males to females Mr Derham thinks pretty juſt, being agreeable to what he had obſerved himſelf. In the hundred years, for inſtance, of his own pariſh-regiſter of Upminſter, though the burials of males and females were nearly equal, being 633 males and 623 females in all that time; yet there were baptized 709 males and but 675 females, which is 13 females to 13.7 males.

From a regiſter kept at Northampton for 28 years, from 1741 to 1770, it appears, that the proportion of males to females that were born in that period is 2361 to 2288, or nearly 13,4 to 13. However, though more males are born than females, Dr Price has ſufficiently ſhown, that there is a conſiderable difference between the probabilities of life among males and females in favour of the latter; ſo that males are more ſhortlived than females; and as the greater mortality of males takes place among children, as well as among males at all ages, the fact cannot be accounted for merely by their being more ſubject to untimely deaths by various accidents, and by their being addicted to the exceſſes and irregularities which ſhorten life. Mr Kerſſeboom informs us, that, during the courſe of 126 years in Holland, females have in all accidents of age lived about three or four years longer than the ſame number of males. In ſeveral towns of Germany, &c. it appears, that of 7270 married perſons who had died, the proportion of married men who died to the married women was 3 to 2; and in Breſlaw for eight years, as 5 to 3. In all Pomerania, during nine years from 1748 to 1756, this proportion was nearly 15 to 11. Among the miniſters and profeſſors in Scotland, 20 married men die to 12 married women, at a medium of 27 years, or in the proportion of 5 to 3; ſo that there is the chance of 3 to 2, and in ſome circumſtances even a greater chance, that the woman ſhall be the ſurvivor of a marriage, and not a man; and this difference cannot be accounted for merely by the difference of age between men and their wives, without admitting the greater mortality of males. In the diſtrict of Vaud in Switzerland, it appears, that half the females do not die till the age of 46 and upwards, though half the males die under 36. It is likewiſe an indiſputable fact, that in the beginning of life, the rate of mortality among males is much greater than among females.

From a table formed by Dr Price, from a regiſter kept for 20 years at Gainſborough, it appears, that of thoſe who live to 80, the major part, in the proportion of 49 to 32, are females. Mr Deparcieux at Paris, and Mr Wargent in Sweden, have farther obſerved, that not only women live longer than men, but that married women live longer than ſingle women. From ſome regiſters examined by Mr Muret in Switzerland, it appears, that of equal numbers of ſingle and married women between 15 and 25, more of the former died than of the latter, in the proportion of 2 to 1.

With reſpect to the difference between the mortality of males and females, it is found to be much leſs in country pariſhes and villages than in towns; and hence it is inferred, that human life in males is more brittle than in females, only in conſequence of adventitious cauſes, or of ſome particular debility, that takes place in poliſhed and luxurious ſocieties, and eſpecially in great towns.

From the inequality above ſtated between the males and females that are born, it is reaſonable to infer, that one man ought to have but one wife; and yet that every woman without polygamy may have a huſband: this ſurpluſage of males above females being ſpent in the ſupplies of war, the ſeas, &c. from which the women are exempt.

Perhaps, ſays Dr Price, it might have been obſerved with more reaſon, that this proviſion had in view that particular weakneſs or delicacy in the conſtitution of males, which makes them more ſubject to mortality: and which conſequently renders it neceſſary that more of them ſhould be produced, in order to preſerve in the world a due proportion between the two ſexes.

That this is a work of Providence, and not of chance, is well made out by the very laws of chance by Dr Arbuthnot; who ſuppoſes Thomas to lay againſt John, that for 12 years running more males ſhall be born than females; and giving all allowances in the computation to Thomas's ſide, he makes the odds againſt Thomas, that it does not ſo happen, to be near five millions of millions of millions of millions to one: but for ages of ages, according to the world's age, to be near an infinite number to one.

According to Mr Kerſſeboom's obſervations, there are about 325 children born from 100 marriages.

Mr Kerſſeboom, from his obſervations, eſtimates the duration of marriages, one with another, as in the following Table.

Thoſe whoſe ages, taken together, make

40, live together, between	24 and	25 years.
50	22	23
60	23	21
70	19	20
80	17	18
90	14	15
100	12	13

Phil. Tranſ. N° 468, ſect. iii. p. 318.

Dr Price has ſhown, that on De Moivre's hypotheſis, or that the probabilities of life decreaſe uniformly (ſee *Complement of Life*) the duration of ſurvivorſhip is equal to the duration of marriage, when the ages are equal: or, in other words, that the expectation of two joint lives, the ages being equal, is the ſame with the expectation of ſurvivorſhip; and, conſequently, the number of ſurvivors or (which is the ſame, ſuppoſing no ſecond marriages) of widows and widowers, alive together, which will ariſe from any given ſet of ſuch marriages conſtantly kept up, will be equal to the whole number of marriages: or half of them (the number of widows in particular) equal to half the number of marriages. Thus the expectation of two joint lives, both 40, is the third of 46 years, or their complement, *i. e.* 15 years and 4 months: and this is alſo the expectation of the ſurvivor. That is, ſuppoſing a ſet of marriages between perſons all 40, they will one with another laſt juſt this time, and the ſurvivors will laſt the ſame time. In adding together the years which any great number of ſuch marriages, and their ſurvivorſhips, have laſted, the ſums would be found to be equal. It is obſerved farther, that if the number expreſſing the expectation of ſingle or joint lives, multiplied by the number of ſingle or joint lives whoſe expectation it is, be added annually to a ſociety, or town the ſum gives the whole number living together, to which ſuch an annual addition would in time grow: thus, ſince 19, or the third of 57, is the expectation of two joint lives whoſe common age is 29, or common complement 57; 20 marriages every year between perſons of this age would in 57 years grow to 20 times 19, or 380 marriages always exiſting together. The number of ſurvivors alſo ariſing from theſe marriages, and always living together, would in twice 57 years increaſe to the ſame number. Moreover, the particular proportion that becomes extinct every year, out of the whole number conſtantly exiſting together of ſingle or joint lives, muſt, wherever this number undergoes no variation, be exactly the ſame with the expectation of the lives at the time when their exiſtence commences. Thus, if it were found that a 19th part of all the marriages among any body of men, whoſe numbers do not vary, are diſſolved every year by the deaths of either the huſband or wife, it would appear, that 19 was at the time they were contracted, the expectation of theſe marriages. Dr Price obſerves, that the annual average of weddings among the miniſters and profeſſors in Scotland for the laſt 27 years has been 31; and the average of married perſons for 17 years ending in 1767, had been 667. This number, divided by 31, gives 21½, the expectation of marriage among them; which, he ſays, is above 2½ years more than the expectation of marriage would be, by Dr Halley's table, on the ſuppoſition, that all firſt, ſecond, and third marriages, may be juſtly conſidered as commencing one with another ſo early as the age of 30; and he has proved, that the expectation of two equal joint lives is to the expectation of a ſingle life of the ſame age as 2 to 3; conſequently, the expectation of a ſingle life at 30, among the miniſters in Scotland, cannot be leſs than 32.25. If we ſuppoſe the mean ages of all who marry annually to be 33 and 25, the expectation of every marriage would be 19 years; or one with another they would be all extinct in 19 years: the marriages which continue beyond this term, though fewer in number, enjoying among them juſt as much more duration as thoſe that fall ſhort of it enjoy leſs. But it appears from the obſervations and tables of Mr Muret, that, in the diſtrict of Vaud (dividing half the number of married perſons, *viz.* 38,328, by the annual medium of weddings, *viz.* 808), the expectation of marriage is only 23½ years: ſo much higher are the probabilities of life in the country than in towns, or than they ought to be, according to De Moivre's hypotheſis.

Marriage *(Maritagium)*, in law, ſignifies not only the lawful joining of a man and wife, but alſo the right of beſtowing a ward or a widow in marriage, as well as the land given in marriage.

Diſſolution of Marriage. See Divorce.

Forcible Marriage. See *Forcible Marriage.*

Frank Marriage. See Frank.

Jactitation of Marriage, in law, is one of the firſt and principal matrimonial cauſes, when one of the parties boaſts or gives out, that he or ſhe is married to the other, whereby a common reputation of their matrimony may enſue. On this ground the party injured may libel the other in the ſpiritual court; and unleſs the defendant undertakes and makes out a proof of the actual marriage, he or ſhe is enjoined perpetual ſilence on that head; which is the only remedy the eccleſiaſtical courts can give for this injury.

Marriage Settlement, is a legal act, previous to marriage, whereby a jointure is ſecured to the wife after the death of the huſband. Theſe ſettlements ſeem to have been in uſe among the ancient Germans, and their kindred nation the Gauls. Of the former Tacitus gives us this account: *Dotem non uxor marito, ſed uxori maritus affert: interſunt parentes et propinqui, et munera probant* (De Mor. Germ. c. 18.) And Cæſar, De Bell. Gallic. lib. vi. c. 18. has given us the terms of a marriage ſettlement among the Gauls, as nicely calculated as any modern jointure: *Viri, quantas pecunias ab uxoribus dotis nomine acceperunt, tantas ex ſuis bonis, æſtimatione facta, cum dotibus communicant. Hujus omnis pecuniæ conjunctim ratio habetur, fructuſque ſervatur.*

Uter

Uter eorum vita ſuperavit, ad eum pars utriuſque cum fructibus ſuperiorum temporum pervenit. The dauphin's commentator ſuppoſes that this Gauliſh cuſtom was the ground of the new regulations made by Juſtinian. Nov. 97. with regard to the proviſion for widows among the Romans; but ſurely there is as much reaſon to ſuppoſe, ſays Judge Blackſtone, that it gave the hint for our ſtatuable jointures. Comment. vol. ii. p. 138.

See an excellent marriage ſettlement by Blackſtone in the appendix to the ſecond volume of his Commentaries.

Duty of Marriage, is a term uſed in ſome ancient cuſtoms, ſignifying an obligation on women to marry.

To underſtand this, it muſt be obſerved, that old maids and widows about ſixty, who held fees in body, or were charged with any perſonal or military ſervices, were anciently obliged to marry, to render thoſe ſervices to the lord by their huſbands, or to indemnify the lord for what they could not do in perſon. And this was called *duty* or *ſervice of marriage*.

Policy of encouraging Marriage. Dr Halley obſerves, that the growth and increaſe of mankind is not ſo much ſtinted by any thing in the nature of the ſpecies, as it is from the cautious difficulty moſt people make to adventure on the ſtate of marriage, from the proſpect of the trouble and charge of providing for a family; nor are the poorer ſort of people herein to be blamed, who, beſides themſelves and families, are obliged to work for the proprietors of the lands that feed them; and of ſuch does the greater part of mankind conſiſt. Were it not for the backwardneſs to marriage, there might be four times as many births as we find; for by computation from the table given under the article Mortality, there are 15,000 perſons above 16 and under 45, of which at leaſt 7000 are women capable of bearing children; yet there are only 1238, or little more than a ſixth part of theſe, that breed yearly: whereas, were they all married, it is highly probable that four of ſix ſhould bring forth a child every year, the political conſequences of which are evident. Therefore, as the ſtrength and glory of a kingdom or ſtate conſiſts in the multitude of ſubjects, celibacy above all things ought to be diſcouraged, as by extraordinary taxing or military ſervice: and, on the contrary, thoſe who have numerous families ſhould be allowed certain privileges and immunities, like the *jus trium liberorum* among the Romans; and eſpecially, by effectually providing for the ſubſiſtence of the poor.

MARROW, in anatomy, a ſoft oleaginous ſubſtance contained in the cavity of the bones. See Anatomy, nº 5.

MARRUBIUM, white horehound: A genus of the gymnoſpermia order, belonging to the didynamia claſs of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The calyx is ſalverſhaped, rigid, and ten-ſtriated; the upper lip of the corolla bifid, linear, and ſtraight. There are nine ſpecies, the moſt remarkable of which is the vulgare, a native of Britain, growing naturally in waſte places, and by way-ſides near towns and villages, but not common. It has a ſtrong and ſomewhat muſky ſmell, and bitter taſte. It is reputed attenuant and reſolvent; an infuſion of the leaves in water, ſweetened with honey, is recomended in aſthmatical and phthiſical complaints, and moſt other diſeaſes of the breaſt and lungs.

MARS, in aſtronomy, one of the five planets, and of the three ſuperior ones; its place being between the earth and Jupiter. See Astronomy, nº 40.

Mars, in Pagan worſhip, the god of war. He was, according to ſome, the ſon of Jupiter and Juno; while others ſay that he was the ſon of Juno alone, who, being diſpleaſed at Jupiter's having produced Minerva from his brain, without female aid, in revenge conceived without the aſſiſtance of the other ſex, by touching a flower ſhown to her by Flora in the plains of Olenus, and became the mother of this formidable deity. The amours of Mars and Venus, and the manner in which Vulcan caught and expoſed them to the laughter of the other gods, have been deſcribed by ſeveral of the ancient poets. He is repreſented as having ſeveral wives and miſtreſſes, and a conſiderable number of children. He was held in the higheſt veneration by the Romans, both from his being the father of Romulus their founder, and from their inclination to conqueſt; and had magnificent temples erected to him at Rome.

Mars is uſually repreſented in a chariot, drawn by furious horſes. He is completely armed; and extends his ſpear with the one hand, and graſps a ſword, imbrued in blood, with the other. He has a fierce and ſavage aſpect. Diſcord is repreſented preceding his car; and Clamour, Fear, and Terror appear in his train. The victims ſacrificed to him were the wolf, the horſe, the wood-pecker, the vulture, and the cock.

Mars, among chemiſts, denotes *iron*; that metal being ſuppoſed to be under the influence of the planet Mars.

MARSAIS (Ceſar Cheſneau du), was born at Marſeilles 1676. He attached himſelf at an early period of life to the order of the congregation of the oratory; but the ſituation was too narrow for his genius, and he ſoon left it. At Paris he married, became advocate, and entered on this new profeſſion with great ſucceſs and approbation. Diſappointed, however, in his expectations of making a ſpeedy fortune, he abandoned the law alſo. About this time the peeviſh humour of his wife occaſioned a ſeparation. We next find him as governor to the ſon of the preſident de Maiſons; and when the premature death of the father deprived him of the fruits of his induſtry, he engaged with the famous Law in the ſame capacity. After the fall of this extraordinary projector, he completed the education of the Marquis de Beaufremont's children, and reared pupils worthy of his genius and induſtry. Although he was accuſed of a tendency to a Deiſm, and though there was good reaſon for the accuſation; yet he never infuſed into the minds of his ſcholars any principle inconſiſtent with ſound morality, or with the Chriſtian religion. When he left M. de Beaufremont's family, he took a boarding houſe, in which, after a method of his own, he educated a certain number of young men. Unexpected circumſtances obliged him to abandon this uſeful undertaking. He was even conſtrained to give ſome occaſional leſſons for the bare neceſſities of life. Without fortune, without hope, and almoſt without reſource, he was reduced to extreme indigence

digence. In this ſituation he was found by the authors of the *Encyclopédie*, and made a partner in conducting that great work. Among many other excellent pieces, the article *Grammar* breathes the ſpirit of ſound philoſophy. His principles are clear and ſolid. He diſcovers an extreme knowledge of the ſubject, great accuracy in the rules, and great propriety in the application. M. le Comte de Lauraguais was ſo much affected with the diſtreſſes, and ſo much convinced of the merit of *Du Marſais*, that he procured him a penſion of one thouſand livres. Du Marſais died at Paris on the 11th June 1756, in his eightieth year, after having received the ſacrament. The compliment which he paid to the prieſt on this occaſion has been conſidered by ſome as rather equivocal. But there is no neceſſity to deprive religion of this triumph, or philoſophy of that honour which conviction and penitence muſt confer on it. "The faith of a great genius (ſays Bayle, who is intitled to credit on this ſubject) is not totally extinguiſhed: It is like a ſpark under the aſhes. Reflection and the proſpect of danger call forth its exertions. There are certain ſituations in which philoſophers are as full of anxiety and remorſe as other men." Whatever were the laſt ſentiments of Du Marſais, it cannot be denied that in the vigour of health he furniſhed ſeveral examples of irreligion, and to theſe have been added many abſurd ſtories. The ſuperiority of Du Marſais's talents conſiſted in exactneſs and perſpicuity. His ignorance of the world, and of the cuſtoms of mankind, together with the greateſt latitude in expreſſing whatever he thought, gave him that frank and unguarded ſimplicity which is often the chief ingredient of genuine humour. Fontenelle uſed to ſay of him, "that he was the moſt lively ſimpleton, and as a man of wit the moſt ſimple, he ever knew." He was the Fontaine of philoſophers. In conſequence of this character, he was a nice judge of what was natural in every production, and a great enemy to all kind of affectation. His principal works are, 1. *Expoſition de la doctrine de l'Egliſé Gallicane par rapport aux pretenſions de la cour de Rome*, 12mo. This accurate work was begun at the deſire of the preſident de Maiſons, and did not appear till after the death of the author. 2. *Expoſition d'une methode raiſonée pour appendre la langue Latine*, 12mo, 1722, rare. This method appears conformable to the natural unfolding of the powers of the mind, and on that account renders the acquiſition of the language leſs difficult; but it was liable to two great objections to vulgar and unenlightened underſtandings, namely, its novelty, and the cenſure which it conveyed againſt the former method. 3. *Traite des tropes*, 1730, 8vo; again printed in 1771, 12mo. This work is intended to explain the different ſignifications of the ſame word. It is a maſter-piece of logic, of accuracy, of perſpicuity, and preciſion. The obſervations and the rules are illuſtrated by ſtriking examples calculated to ſhow both the uſe and the abuſe of the rhetorical figures. It is wonderful at the ſame time that this excellent book had very little ſale, and is ſcarcely known. A gentleman who wanted to compliment the author on this extraordinary performance, told him that he had heard a great deal of his *Hiſtoire des Tropes*, and begged to know in what particular part of the world the nation flouriſhed. 4. *Les veritable principes de la Grammaire raiſonée pour apprendre la langue Latine*, 1729, 4to. There was only the preface of this work publiſhed, in which he introduced the greateſt part of his *methode raiſonée*. 5. *Labiege de la fable du Pere Jouvenci*, arranged after the manner of the original plan, 1731, 12mo. 6. *Une reponſe manuſcrite a la Critique de l'hiſtoire des oracles par le Pere Baltus.* There are only imperfect fragments of theſe papers to be found.—7. *Logique, ou reflections ſur les operations de l'eſpirit*. This is a ſhort tract, which nevertheleſs contains every thing neceſſary to be known on the art of reaſoning. It was reprinted at Paris, in two parts, together with the articles which he had furniſhed for the *Encyclopédie*, 1762. We ſhall altogether omit ſeveral other performances, calculated to diſſeminate the principles of Deiſm or profanity; which, though they are publiſhed in his name, may be ſpurious, and at any rate deſerve not to be drawn from that oblivion into which they have fallen.

MARSAL, a town of France, in Lorrain, remarkable for its ſalt-works; ſeated in a marſh on the river Selle, of difficult acceſs, which, together with the fortifications, render it an important place. E. Long. 6. 43. N. Lat. 48. 46.

MARSALA, an ancient and ſtrong town of Sicily, in the valley of Mazara. It is well peopled, and built on the ruins of the ancient Lilybœum. E. Long. 12. 37. N. Lat. 37. 52.

MARSAM, or MOUNT MARSAN, a town of France, in Gaſcony, and capital of a ſmall territory of the ſame name, fertile in wine; ſeated on the river Miduſe, in W. Long. 0. 39. N. Lat. 44. 0.

MARSAQUIVER, or MARSALQUIVER, a ſtrong and ancient town of Africa, on the coaſt of Barbary, and in the province of Beni-Arax, in the kingdom of Tremeſen, with one of the beſt harbours in Africa. It was taken by the Spaniards in 1732. It is ſeated on a rock near a bay of the ſea, in W. Long. 0. 10. N. Lat. 35. 40.

MARSEILLES, a ſtrong ſea-port, and the richeſt town of Provence, in France. Here is a good harbour, where the French galleys are ſtationed; for it will not admit large men of war. The entrance of the harbour, which is extremely narrow and ſurrounded by lofty mountains, protects and ſhelters veſſels during the moſt violent ſtorms. The port itſelf forms a delightful walk even in the middle of winter, as it is open to the ſouthern ſun, and crowded with vaſt numbers of people not only of all the European nations, but of Turks, Greeks, and natives of the coaſt of Barbary. The whole ſcene is one of the moſt agreeable that can be imagined, if the chains of the galley ſlaves heard among the hum of buſineſs did not tincture it with the hateful idea of ſlavery. The galleys themſelves, uſeleſs and neglected, rot peaceably in their reſpective ſtations; and it is ſaid that no others will ever be conſtructed to ſupply their place, as they have long ceaſed to be of any utility to the ſtate, and are ſcarcely even navigable in ſevere weather. Marſeilles pretends to the moſt remote antiquity; a colony of Phocians, in ages unknown, having given it birth. It is divided into the Old Town and the New; which are ſeparated by a ſtreet, bordered with trees on each ſide. The Old Town is one of the moſt ill built of any in Europe. The New has ſprung up ſince the commencement of the 18th century, and has all that regularity, elegance, and convenience, which diſtinguiſh the preſent times. It is ſaid to contain 100,000 inhabitants, and is one of the moſt trading towns in France. Without the walls is the caſtle of Notre-Dame, which is very well fortified. It is a biſhop's ſee, and there is a French academy; it having been noted at all times for men of learning. In 1660, Louis XIV. built the citadel and fort St John to keep the inhabitants in awe, becauſe they pretended to be free. The Jeſuits had a very fine obſervatory here; and in the arſenal, built not long ago, there are arms for 40,000 men. In the Houſe of Diſcipline they weave gold, ſilver, and ſilk brocades. The drugs are brought thither from all parts of the world. It is ſeated on the north ſhore of the Mediterranean, in E. Long. 4. 27. N. Lat. 43. 18. The ſurrounding country is rocky and barren, but covered for ſeveral miles on all ſides with villas and ſummer houſes, which commerce has erected.

MARSH (Narciſſus), an exemplary Iriſh prelate, born at Hannington in Wiltſhire in 1638. He was made principal of St Alban's hall, Oxford, in 1673, but removed to the provoſtſhip of Dublin college in 1678. He was promoted to the biſhopric of Leighlin and Ferns in 1682, tranſlated to the archbiſhopric of Caſhel in 1690, to Dublin in 1694, and to Armagh in 1703. While he held the ſee of Dublin, he built a noble library for the uſe of the public, filled it with choice books, and ſettled a proviſion for two librarians. He repaired, at his own expence, ſeveral decayed churches, beſides buying in and reſtoring many impropriations, and preſenting a great number of oriental MSS to the Bodleian library. He was a very learned and accompliſhed man; was well verſed in ſacred and profane literature, in mathematics, natural philoſophy, the learned languages, eſpecially the oriental, and in both the theory and practice of muſic. He publiſhed, 1. *Inſtitutiones logicæ*.—2. *Manuductio ad logicam*, written by Philip de Trieu; to which he added the Greek text of Ariſtotle and ſome tables and ſchemes. 3. An introductory eſſay on the doctrine of ſounds, &c. He died in 1713.

MARSH, ſignifies a piece of ground flowed with water, yet ſo that the graſs and other vegetables riſe above the ſurface of the water, and, by their decaying, give riſe to putrid effluvia, which are very pernicious to the human body.

MARSHAL, or MARESCHAL, (*mareſcallus*), primarily denotes an officer who has the care or the command of horſes.—Nicod derives the word from *polemarchus*, "maſter of the camp;" Mathew Paris from *Martis ſeneſcallus*. In the old Gauliſh language, *march* ſignified "horſe;" whence *marechal* might ſignify "him who commanded the cavalry. Other derivations have been given by different authors; and the name itſelf has been applied to officers of very different employments.

Marshal of France, the higheſt dignity of preferment in the French armies. The dignity of marſhal came to be for life, though at its firſt inſtitution it was otherwiſe. They were then only the kings firſt ecuyers under the conſtable; but in time they became the conſtables lieutenants in the command of the army, the conſtable himſelf being then become captain-general. At firſt they were but two in number; and their allowance was but 500 livres *per annum* in time of war, and nothing in time of peace: but in the reign of Francis I. a third was added; Henry II. created a fourth. Since it has been various; Louis XIV. increaſed it to 20. Their office at firſt was to marſhal the army under the conſtable, and to command in his abſence. They did then what the *marſhals de camp* do now; to which laſt they have given their title, and the leaſt conſiderable part of their authority.

Earl Marshal of Scotland. His office was to command the cavalry, whereas the CONSTABLE commanded the whole army. They ſeem, however to have had a ſort of joint command, as of old all orders were addreſſed "to our conſtable and mariſchal." The office of earl mariſchal has never been out of the noble family of Keith. It was reſerved at the union; and when the heritable juriſdictions were bought, it was in the crown, being forfeited by the rebellion of Geo. Keith, earl mariſchal, in 1715.

Earl Marshal of England is the eighth great officer of ſtate. This office, until it was made hereditary, always paſſed by grant from the king, and never was held by tenure or ſerjeanty (by any ſubject) as the offices of lord high ſteward and lord high conſtable were ſometimes held. The title is perſonal, the office honorary and officiary. They were formerly ſtyled *lord marſhal* only, until king Richard II. June 20. 1397, granted letters-patent to Thomas Mowbray, earl of Nottingham, and to the heirs male of his body lawfully begotten, by the name and ſtyle of *earl marſhal*; and further, gave them power to bear in their hand a gold truncheon, enamelled with black at each end; having at the upper end of it the king's arms engraven thereon, and at the lower end his own arms.

King James I. was pleaſed, by letters-patent, dated Auguſt 29th 1622, to conſtitute Thomas Howard, earl of Arundel and Surrey, earl marſhal for life; and the next year, the ſame king granted (with the advice of the privy-council) letters-patent, wherein it was declared, that during the vacancy of the office of lord high conſtable of England, the earl marſhal had the like juriſdiction in the court of chivalry, as both conſtable and marſhal jointly ever exerciſed. See CHIVALRY (*Court of*).

On the 19th of October 1672, king Charles II. was pleaſed to grant to Henry lord Howard, and the heirs-male of his body lawfully begotten, the office and dignity of earl marſhal of England, with power to execute the ſame by deputy or deputies, in as full and ample a manner as the ſame was heretofore executed by Henry Howard, lord Maltravers, late earl of Arundel, Surrey, and Norfolk, grandfather to the ſaid Henry lord Howard; or by Thomas Howard late duke of Norfolk, grandfather to the ſaid Thomas Howard, late earl of Arundel, Surrey, and Norfolk; or by Thomas Howard duke of Norfolk, grandfather of the ſaid Thomas Howard duke of Norfolk; or by John Mowbray duke of Norfolk, or any other earl marſhal of England; with a penſion of L. 20 each year, payable out of the Hanaper office in chancery; and on default of the iſſue male of the ſaid Henry lord Howard,

Howard, with limitation to the heirs-male lawfully begotten of the body of the ſaid Thomas Howard, earl of Arundel, &c.; and, on the default of ſuch iſſue, to deſcend in like manner to the heirs-male of Thomas late earl of Suffolk; and, on default of his iſſue-male, to the heirs-male of Lord William Howard, late of Naworth in the county of Cumberland, youngeſt ſon to Henry Howard late duke of Norfolk; and on default of his iſſue-male, to Charles Howard earl of Nottingham, and the heirs-male of his body lawfully begotten.

*Field-*MARSHAL, an office of high rank in the European armies. It is now, however, diſuſed in the Britiſh army; Lord Tyrawley was the laſt, appointed in 1763.

Knight MARSHAL, or MARSHAL *of the King's Houſe*, an Engliſh officer, whoſe buſineſs, according to Fleta, is to execute the commands and decrees of the lord ſteward, and have the cuſtody of priſoners committed by the court of verge. Under him are ſix marſhal's men, who are properly the king's bailiffs, and arreſt in the verge of the court, when a warrant is backed by the board of green-cloth. The court where cauſes of this kind, between man and man are tried, is called the *Marſhalſea*, and is under the knight marſhal. See MARSHALSEA.

This is alſo the name of the priſon in Southwark; the reaſon of which may probably be, that the marſhal of the king's houſe was wont to ſit there in judgement, or keep his priſon.

MARSHAL *of the King's Bench*, an officer who has cuſtody of the priſon called the *King's Bench* in Southwark.—He gives attendance upon the court, and takes into his cuſtody all priſoners committed by the court; he is fineable for his abſence, and non-attendance incurs a forfeiture of his office. The power of appointing the marſhal of the king's bench is in the crown.

In Fleta mention is alſo made of a *marſhal of the exchequer*, to whom the court commits the cuſtody of the king's debtors, &c.

MARSHAL (Thomas), a very learned Engliſh divine in the 17th century, was educated at Oxford. This city being garriſoned upon the breaking out of the civil wars, he bore arms for the king. Afterward he had ſeveral ſucceſſive preferments in the church; and died at Lincoln-college, of which he was rector. By his will he left all his books and MSS. to the univerſity of Oxford, and money to Lincoln-college for the maintenance of three ſcholars. He was a noted critic, eſpecially in the Gothic and Engliſh-Saxon tongues; and eminent for his piety and other valuable qualities. He wrote, 1. *Obſervationes in Evangeliorum verſiones per antiquos duos, Goth, ſcilicet & Anglo-Sax.* &c. 2. Notes on the church-catechiſm. &c.

MARSHALLING *a* COAT, in heraldry, is the diſpoſal of ſeveral coats of arms belonging to diſtinct families in one and the ſame eſcutcheon or ſhield, together with their ornaments, parts, and apurtenances. See HERALDRY, chap. vi. p. 466.

MARSHALSEA *(the Court of)*, and the *Palace-court* at Weſtminiſter, though two diſtinct courts, are frequently confounded together. The former was originally holden before the ſteward and marſhal of the king's houſe, and was inſtituted to adminiſter juſtice between the king's domeſtic ſervants, that they might not be drawn into other courts, and thereby the king loſe their ſervice. It was formerly held in, though not a part of, the *aula regis*; and, when that was ſubdivided, remained a diſtinct juriſdiction: holding plea of all treſpaſſes committed within the verge of the court, where only one of the parties is in the king's domeſtic ſervice (in which caſe the inqueſt ſhall be taken by a jury of the country); and of all debts, contracts, and covenants, where both of the contracting parties belong to the royal houſehold; and then the inqueſt ſhall be compoſed of men of the houſehold only. By the ſtatute of 13 Ric. II. ſt. 1. c. 3 (in affirmance of the common law), the verge of the court in this reſpect extends for 12 miles round the king's palace of reſidence. And, as this tribunal was never ſubject to the juriſdiction of the chief juſticiary, no writ of error lay from it (though a court of record) to the king's-bench, but only to parliament, till the ſtatutes of 5 Edw. III. c. 2. and 10 Edw. III. ſt. 2. c. 3. which allowed ſuch writ of error before the king in his place. But this court being ambulatory, and obliged to follow the king in all his progreſſes, ſo that by the removal of the houſehold actions were frequently diſcontinued, and doubts having ariſen as to the extent of its juriſdiction, king Charles I. in the ſixth year of his reign, by his letters-patent, erected a new court of record, called the *curia palatii*, or *palace-court*, to be held before the ſteward of the houſehold and knight-marſhal, and the ſteward of the court, or his deputy; with juriſdiction to hold plea of all manner of perſonal actions whatſoever, which ſhall ariſe between any parties within 12 miles of his majeſty's palace at Whitehall. The court is now held once a week, together with the ancient court of marſhalſea, in the borough of Southwark: and a writ of error lies from thence to the court of king's-bench. But if the cauſe is of any conſiderable conſequence, it is uſually removed on its firſt commencement, together with the cuſtody of the defendant, either into the king's-bench or common-pleas by a writ of *habeas corpus cum cauſa:* and the inferior buſineſs of the court hath of late years been much reduced, by the new courts of conſcience erected in the environs of London; in conſideration of which the four counſels belonging to theſe courts had ſalaries granted them for their lives by the ſtat. 23. Geo. II. c. 27.

MARSHAM (Sir John): a very learned Engliſh writer in the 17th century. He ſtudied the law in the Middle-Temple, and was ſworn one of the ſix clerks in the courts of chancery in 1638. In the beginning of the civil wars he followed the king to Oxford; for which he was ſequeſtered of his place by the parliament at Weſtminiſter, and plundered. After the declining of the king's affairs, he returned to London; compounded, among other royaliſts, for his real eſtate; and betook himſelf wholly to his ſtudies and a retired life, the fruits of which were ſome excellent works. He wrote *Diatriba Chronologica; Chronicus Canon, Ægyptiacus, Ebraicus, Græcus*, &c. He died in 1685.

MARSHFIELD, a town of Gloceſterſhire, 7 miles from Bath, 12 from Chipping-Sodbury, 12½ from Briſtol, 35 from Gloceſter, and 104 from London, on the road to Briſtol, and on the very borders of Wilts. It is a conſiderable clothing-town, drives a good trade in malt, and is famous for cakes. It conſiſts chiefly of one ſtreet of old buildings near a mile long; and is governed by a bailiff. It has a large church, with a well endowed alms-houſe and a chapel to it for eight poor people, and a charity-ſchool; and it has a weekly market and two fairs.

MARSHLAND, a marſhy peninſula in the county of Norfolk, oppoſite to King's-Lynn, almoſt ſurrounded with the Ouſe and other navigable rivers, and an arm of the ſea. It ſeems formerly to have been recovered out of the ocean, from whoſe inundations it could never be altogether defended: and in Sir Henry Spelman's time it ſuffered two general ones, viz. one from the ſalt-water, the other from the freſhes; by the laſt of which the inhabitants ſuffered 42,000l. damage. It contains about 30,000 acres, which turn to more profit by grazing than ploughing. It is about 10 miles in the wideſt place, and has no leſs that 111 brick bridges. The commonage of it belongs to ſeven villages that ſurround it. The air is ſo unhealthy, that an ague is commonly called the *Marſhland-bailiff*.

MARSHMALLOW, in botany. See Althæa.

MARSI, a nation of Germany, who afterwards came to ſettle in Italy, where they occupied the territory in the environs of the Fucine Lake. They at firſt proved very inimical to the Romans, but in proceſs of time they became its firmeſt ſupporters. They were allowed by the Romans to be the moſt intrepid ſoldiers of their legions when in friendſhip, and the moſt formidable of their enemies when at variance; and it was a common ſaying, that Rome could neither triumph over the Marſi nor without them. They are particularly celebrated for the civil war in which they were engaged, and which from them has received the name of the *Marſian war*. The large contributions they made to ſupport the intereſt of Rome, and the number of men which they continually ſupplied to the republic, rendered them bold and aſpiring; and they claimed, with the reſt of the Italian ſtates, a ſhare of the honour and privileges which were enjoyed by the citizens of Rome. This petition, though ſupported by the intereſt, the eloquence, and integrity of the tribune Druſus, was received with contempt by the Roman ſenate; upon which, in the 662d year of Rome, the Marſi put themſelves at the head of the ſocial war, one of the moſt obſtinate and dangerous oppoſitions ever made to the progreſs of the Roman power. They obtained ſeveral victories: but they were at laſt defeated: though the war was not terminated but by a grant of thoſe privileges for which they contended.

MARSICO Nuovo, a ſmall, rich, and handſome town of Italy, in the kingdom of Naples, and in the Hither Principato, with a biſhop's ſee. It is ſeated at the foot of the Apennines, near the river Agri, in E. Long. 15. 49. N. Lat. 20. 42.

MARSIGLI (Lewis Ferdinand, count), an Italian famous for letters as well as arms, was deſcended from an ancient and noble family, and born at Bologna in 1658. He acquired a great knowledge in the art of war and fortification; ſerved under the emperor Leopold II. againſt the Turks, by whom he was taken priſoner in 1683 but redeemed, after a year's captivity. In the Spaniſh ſucceſſion war, Marſigli, then advanced to the rank of marſhal, being in the fortreſs of Briſac, which ſurrendered to the duke of Burgundy in 1703, when the place was deemed capable of holding out much longer, was ſtripped of all his commiſſions, and had his ſword broke over him; and the count d'Arco who commanded was beheaded. Marſigli now ſought for conſolation in the ſciences; as, amidſt all the hurry and fatigue of war, he had made all the advantages the moſt philoſophic man could do, who had travelled purely in queſt of knowledge. He had a rich collection of every thing proper to the advancement of natural knowledge, inſtruments aſtronomical and chemical, plans of fortifications, models of machines, &c. all wich he preſented to the ſenate of Bologna by an authentic act in 1712, forming at the ſame time out of them what he called *the inſtitute of the arts and Sciences at Bologna*. He alſo founded a printing-houſe, and furniſhed it with the beſt types for Latin, Greek, Hebrew, and Arabic, which he preſented in 1728 to the Dominicans at Bologna, on condition of their printing all the writings of the *inſtitute* at prime coſt: this was called *the printing-houſe of St Thomas Aquinas*. His writings on philoſophical ſubjects are numerous and valuable, in Latin, Italian, and French: he died in 1730.

MARSTON (John), an Engliſh dramatic writer, who lived in the time of James I. Wood ſays he was a ſtudent in Corpus Chriſti college, Oxford; but we neither know his family nor the time of his birth. He contributed eight plays to the ſtage, which were all acted at Black-friars with applauſe; and one of them, called the *Dutch Courtezan*, was once revived ſince the Reſtoration, under the title of the *Revenge*, or a *Match in Newgate*. There is no account when he died; but we find his works were publiſhed after his death by Shakeſpeare, and may thence reaſonably conclude that it happened about the year 1614. He was a chaſte and pure writer; avoiding all that obſcenity, ribaldry, and ſcurrility, which too many of the play-writers of that time, and indeed much more ſo in ſome periods ſince, have made the baſis of their wit, to the great diſgrace and ſcandal of the ſtage.

MARSYAS (fab. hiſt.), a celebrated muſician of Celænæ in Phrygia, ſon of Olympus, or of Hyagnis, or Œagrus. He was ſo ſkilled in playing on the flute, that he is generally deemed the inventor of it. According to the opinion of ſome, he found it when Minerva had thrown it aſide on account of the diſtortion of her face when ſhe played upon it. Marſyas was enamoured of Cybele, and he travelled with her as far as Nyſa, where he had the imprudence to challenge Apollo to a trial of his ſkill as a muſician. The god accepted the challenge, and it was mutually agreed that he who was defeated ſhould be flead alive by the conqueror. The Muſes, or (according to Diodorus) the inhabitants of Nyſa, were appointed umpires. Each exerted his utmoſt ſkill, and the victory with much difficulty was adjudged to Apollo. The god upon this tied his antagoniſt to a tree, and flead him alive; (See Apollo.) The death of Marſyas was univerſally lamented: the Fauns, Satyrs, and Dryads, wept at his fate; and from their abundant tears aroſe a river of Phrygia, well known by the name of *Mar-*

ſyas. The unfortunate Marſyas is often repreſented on monuments, as tied with his hands behind his back to a tree, while Apollo ſtands before him with his lyre in his hands. In independent cities, among the ancients, the ſtatue of Marſyas was generally erected in the forum, to repreſent the intimacy which ſubſiſted between Bacchus and Marſyas as the emblems of liberty. At Celænæ, the ſkin of Marſyas was ſhown to travellers for ſome time. It was ſuſpended in the public place, in the form of a bladder or a foot ball.

The ſources of the Marſyas were near thoſe of the Mæander, and thoſe two rivers had their confluence a little below the town of Celænæ.

MART, a great fair held every year for buying and ſelling goods. Public marts, or places of buying and ſelling, ſuch as markets and fairs, with the tolls thereunto belonging, can only be ſet up in England by virtue of the king's grant, or by long and immemorial uſage and preſcription, which preſuppoſes ſuch a grant. The limitation of theſe public reſorts, to ſuch time and place as may be moſt convenient for the neighbourhood, forms a part of economics, or domeſtic polity; which conſidering the kingdom as a large family, and the king as the maſter of it, he has a right to diſpoſe and order as he pleaſes.

MARTABAN, a province of Aſia, in the kingdom of Pegu, lying in the gulph of Bengal. It is a country that produces rice and all kinds of fruits proper to the climate. It has mines of ſeveral ſorts of metals, and carries on a great trade. The chief town, which is of the ſame name, is rich, handſome, and very populous, with a good harbour. E. Long. 97. 50. N. Lat. 15. 35.

MARTEAU, the name given by French naturaliſts to a peculiar ſpecies of oyſters, called alſo *malleam* by others. It is one of the moſt curious ſhells in the world. Its figure is that of a hammer, with a very long head, or rather of a pick-ax. It has a body of moderate thickneſs, and two long arms. It is of a browniſh colour, with a beautiful tinge of a violet-blue. Notwithſtanding the ſtrange ſhape of theſe ſhells, they cloſe very exactly.

MARTHA (St), a province of South America, on the coaſt of Terra Firma, bounded on the north by the North Sea, on the eaſt by Rio de la Hache, on the ſouth by New-Granada, and on the weſt by Carthagena. It is 300 miles in length and 200 in breadth, is a mountainous country, and the land very high. Here begins the famous ridge of mountains called the *Cordilleras des los Andes*, which run from north to ſouth the whole length of the continent of South America. It is extremely hot on the ſea-coaſt; but cold in the internal parts, on account of the mountains. It abounds with the fruits proper to the climate; and there are mines of gold and precious ſtones, alſo ſalt-works. The Spaniards poſſeſs but one part of this province, in which they have built Martha the capital. The air about the town is wholeſome; and is ſeated near the ſea, having a harbour ſurrounded with high mountains. It was formerly very conſiderable when the galleons were ſent thither, but is now come almoſt to nothing. W. Long. 74. 11. N. Lat. 11. 20.

MARTHA (St), or *Sierra Neveda*, a very high mountain in New Spain. Some ſay it is 100 miles in circumference at the bottom, and five miles in height. The top is always covered with ſnow in the hotteſt weather; and the French affirm, that they can perceive it from the iſland of St Domingo, which is 370 miles diſtant. W. Long. 74. 35. N. Lat. 8. 0.

Martha's Vinyard, an iſland of North America near the coaſt of New-England, 80 miles ſouth of Boſton. The inhabitants apply themſelves chiefly to their fiſheries, in which they have great ſucceſs. W. Long. 70. 34. N. Lat. 41. 0.

MARTIAL, is ſometimes uſed to expreſs preparations of iron, or ſuch as are impregnated therewith; as the martial regulus of antimony, &c.

Martial-Court. See *Court-Martial.*

Martial Law, in England, is the law of war that depends upon the juſt but arbitrary will and pleaſure of the king, or his lieutenant: for though the king doth not make any laws but by common conſent of parliament yet, in time of war, by reaſon of the neceſſity of it to guard againſt dangers that often ariſe, he uſeth abſolute power, ſo that his word is a law. *Smith de Repub. Ang. lib.* 3. *c.* 4.

But the martial law (according to Chief Juſtice Hale), is in reality not a law, but ſomething indulged rather than allowed as a law; and it relates only to members of the army, being never intended to be executed on others, who ought to be ordered and governed by the laws to which they are ſubject, though it be a time of war. And the exerciſe of martial law, whereby any perſon may loſe his life, or member, or liberty, may not be permitted in time of peace, when the king's courts are open for all perſons to receive juſtice.

MARTIALIS (Marcus Valerius), a famous Latin poet, born at Bilbilis, now called *Bubiera*, in the kingdom of Arragon in Spain, was of the order of knights. He went to Rome at the age of 21, and ſtaid there 35 years, under the reign of Galba and the ſucceeding emperors, till that of Trajan; and having acquired the eſteem of Titus and Domitian, he was created tribune. At length, finding that he was neglected by Trajan, he returned to his own country Bilbilis, where he married a wife, and had the happineſs to live with her ſeveral years. He admires and commends her much, telling her that ſhe alone was ſufficient to ſupply the want of every thing he enjoyed at Rome. "*Romam tu mihi ſola facis*," ſays he, in the 21ſt epigram of the 12th book. She appears likewiſe to have been a lady of a very large fortune; for, in the 31ſt epigram of the ſame book, he extols the magnificence of the houſe and gardens he had received from her, and ſays that ſhe had made him a little kind of monarch."

Munera ſunt domino: poſt ſeptima luſtra reverſo,
Has Marcella domos, parvaque regna dedit.

There are ſtill extant 14 books of his epigrams, filled with points, a play upon words, and obſcenities. The ſtyle is affected. However ſome of his epigrams are excellent; many of them are of the middling kind; but the greateſt part of them are bad: ſo that Martial never ſpoke a greater truth, than when he ſaid of his own works,

Sunt bona, ſunt quædam mediocra, ſunt mala plura.

There is alſo attributed to him a book on the ſpectacles of the amphitheatre; but the moſt learned critics think that this laſt work was not written by Martial. The beſt editions of Martial are, that *in Uſum Delphini*, 4to, Paris, 1617, and that *cum Notis Variorum*.

MARTIGUES, a ſea-port town of France, in Provence, with the title of a principality; ſeated near a lake 12 miles long and five broad, which is navigable throughout, and from whence they get excellent ſalt. E. Long. 4. 20. N. Lat. 43. 38.

MARTIN (St.), was born at Sabaria in Pannonia, (at preſent *Stain* in Lower Hungary), in the beginning of the fourth century. His father was a military tribune; and he himſelf was obliged to carry arms, although peace and ſolitude were much more agreeable to his inclination. He was remarkable for every virtue, in a profeſſion which is generally conſidered to give a ſanction to vice. He divided his coat with a naked wretch whom he met at the gate of Amiens; and it is reported, that Jeſus Chriſt appeared to him on the night following, clothed in this half of his coat. Martin was then a catechumen; but he ſoon afterwards received baptiſm, and renounced the military profeſſion for the eccleſiaſtical. After paſſing many years in ſolitude, St Hilary biſhop of Poictiers gave him the power to caſt out devils. On his return to Pannonia, he perſuaded his mother to embrace Chriſtianity; and with great zeal and activity oppoſed the Arians, who governed the church in Illyria. When he was publicly whipt for giving teſtimony to the divinity of Chriſt, he bore the puniſhment with the conſtancy and patience of the firſt martyrs. This illuſtrious champion for Chriſtianity, when he heard that St Hilary was returned from baniſhment, went and ſettled in the neighbourhood of Poictiers. In this retirement, a great number of monks placed themſelves under his direction. His virtues became every day more ſplendid and remarkable, till he was drawn from his ſolitude, and with the general approbation of the clergy and people elected biſhop of Tours in the year 374. To the zeal and charity of a biſhop, he joined the humility and poverty of an anchorite. That he might detach himſelf more from the world, he built the celebrated monaſtery of Marmoutier, which ſtill remains, and which is believed to be the oldeſt abbey in France. It is ſituated near the city of Tours, betwixt the Loire and a ſteep rock. In this ſituation, together with 80 monks, St Martin diſplayed the moſt exemplary ſanctity and mortification, nor were there any monks better diſciplined than thoſe of Marmoutier. After he had converted his dioceſe to the Chriſtian faith, he became the apoſtle of all Gaul. He diffuſed the doctrines of Chriſtianity among the heathens, deſtroyed their temples, and (according to the writers of his life) confirmed the truth by an infinite number of miracles. The emperor Valentinian, at that time in Gaul, received him with every mark of reſpect and honour. The tyrant Maximus, who had revolted againſt the emperor Gratian, and ſeized on Spain, England, and Gaul, received him in a manner no leſs diſtinguiſhed. The holy biſhop attended him at Trieves in the year 383, to ſolicit ſome favours. Maximus made him ſit at his table with the moſt illuſtrious perſons of his court, and placed him at his right hand. In drinking, the uſurper commanded his ſervants to give him a cup, that he might again receive it from him; but this extraordinary prelate gave it to the prieſt who accompanied him on his journey. This holy boldneſs, far from diſpleaſing them, gained him the favour of the emperor and of his court. Martin, who was an enemy to hereſy, but a friend to mankind, employed his influence with this prince to preſerve the Priſcillianiſts, who were proſecuted by Ithace and by Idace, biſhops of Spain. The biſhop of Tours would hold no communion with men whoſe principles of religion inclined them to ſhed the blood of mankind; and he obtained the life of thoſe whoſe death they had ſolicited. On his return to Tours, he prepared himſelf for the reward of his labours in another world. He died at Candes the 8th of November 397, but according to others on the 11th of November 400. His name is given to a particular opinion concerning the myſtery of the holy Trinity. St Martin is the firſt of the ſaints confeſſors to whom the Latin church offered public prayers. His life is written in elegant Latin by Fortunatus, and Sulpitius Severus one of his diſciples. Paul of Perigueux and Fortunatus of Poictiers have given us Sulpicius's life of Martin in verſe; but they have debaſed the admirable proſe of the author by a wretched poetical imitation. Nicolas Gervais wrote alſo the life of St Martin, full of many curious and entertaining facts, publiſhed at Tours in 1699, in 4to. The tradition at Amiens is, that St Martin performed the act of charity which rendered him ſo famous, near an ancient gate of the city, of which the ruins are ſtill viſible. The following Latin verſes, which do more honour to the ſaint than to the poet, are inſcribed on one of the ſtones:

Hic quondam veſtem Martinus dimidiavit;
Ut faceremus idem, nobis exemplificavit.

MARTIN (Benjamin), one of the moſt eminent artiſts and mathematicians of the age, was born in 1704. After publiſhing a variety of ingenious treatiſes, and particularly a Scientific Magazine under his own name, and carrying on for many years a very extenſive trade as an optician and globe-maker in Fleetſtreet, the growing infirmities of age compelled him to withdraw from the active part of buſineſs. Truſting too fatally to what he thought the integrity of others, he unfortunately, though with a capital more than ſufficient to pay all his debts, became a bankrupt. The unhappy old man, in a moment of deſpiration from this unexpected ſtroke, attempted to deſtroy himſelf; and the wound, though not immediately mortal, haſtened his death, which happened February 9th 1782, in his 78th year. He had a valuable collection of foſſils and curioſities of almoſt every ſpecies; which, after his death, were almoſt given away by public auction. His principal publications, as far as they have occured to recollection, are, The Philoſophic Grammar; being a view of the preſent ſtate of experimental phyſiology, or natural philoſophy, 1735, 8vo. A new, complete, and univerſal Syſtem or Body of Decimal Arithmetic, 1735, 8vo. The young Students Memorial Book, or Patent Library, 1735, 8vo. Deſcription and Uſe of both the Globes, the Armillary Sphere and Orrery, Trigonometry, 1736, 2 vols 8vo.

Memoirs of the Academy of Paris, 1740, 5 vols. Syſtem of the Newtonian Philoſophy, 1759, 3 vols. New Elements of Optics, 1759. Mathematical Inſtitutions, viz. Arithmetic, Algebra, Geometry, and Fluxions, 1759. Natural Hiſtory of England, with a Map of each County, 1759, 2 vols. Philology, and Philoſophical Geography, 1759. Mathematical Inſtitutions, 1764, 2 vols. Lives of Philoſophers, their Inventions, &c. 1764. Introduction to the Newtonian Philoſophy, 1765. Inſtitutions of Aſtronomical Calculations, 2 parts, 1765. Deſcription and Uſe of the Air-pump, 1766. Deſcription of the Torricellian Barometer, 1766. Appendix to the Deſcription and Uſe of the Globes, 1766. Philoſophia Britannica, 1778, 3 vols. Gentleman and Lady's Philoſophy, 3 vols. Miſcellaneous Correſpondence, 4 vols. Syſtem of Philology. Philoſophical Geography. Magazine complete, 14 vols. Principles of Pump-work. Theory of the Hydrometer. Doctrine of Logarithms.

MARTIN (St.), a ſmall but ſtrong town of France, in the iſle of Rhé, with a harbour and a ſtrong citadel, fortified after the manner of Vauban. The iſland lies near the coaſt of Poitou. W. Long. 1. 0. N. Lat. 45. 40.

Cape MARTIN, a promontory of Valencia in Spain, near a town called *Denia*, and ſeparates the gulph of Valencia from that of Alicant.

MARTIN (St.), an iſland of America, and one of the Caribbees, lying on the gulph of Mexico, to the north-weſt of St Bartholomew, and to the ſouth-weſt of Anguilla. It is 42 miles in circumference; has neither harbour nor river, but ſeveral ſalt-pits. After various revolutions, it is at length in poſſeſſion of the French and Dutch, who poſſeſs it conjointly. W. Long. 62. 35. N. Lat. 18. 15.

MARTIN, in zoology. See HIRUNDO and MUSTELA.

Free MARTIN, in zoology, is a name given in this country to a cow-calf, caſt at the ſame time with a bull-calf, which is a kind of hermaphrodite that is never known to breed nor to diſcover the leaſt inclination for the bull, nor does the bull ever take the leaſt notice of it. See HERMAPHRODITE.

MARTINGALE, in the manege, a thong of leather, faſtened to one end of the girths under a horſe's belly, and at the other end to the muſs-roll, to keep him from rearing.

MARTINICO, the chief of the French Caribbee iſlands, the middle of which is ſituated in W. Long. 61. 0. N. Lat. 14. 30.

This iſland was firſt ſettled by M. Deſnambuc a Frenchman, in the year 1635, with only 100 men from St Chriſtopher's. He choſe rather to have it peopled from thence than from Europe; as he foreſaw, that men, tired with the fatigue of ſuch a long voyage, would moſtly periſh ſoon after their arrival, either from the climate, or from the hardſhips incident to moſt emigrations. They completed their firſt ſettlement without any difficulty. The natives, intimidated by their fire-arms, or ſeduced by promiſes, gave up the weſtern and ſouthern parts of the iſland to the new comers. In a ſhort time, however, perceiving the number of theſe enterpriſing ſtrangers daily increaſing, they reſolved to extirpate them, and therefore called in the ſavages of the neighbouring iſlands to aſſiſt them. They fell jointly upon a little fort that had been haſtily erected; but were repulſed, with the loſs of 700 or 800 of their beſt warriors, who were left dead upon the ſpot.

After this check, the ſavages for a long time diſappeared entirely; but at laſt they returned, bringing with them preſents to the French, and making excuſes for what had happened. They were received in a friendly manner, and the reconciliation ſealed with pots of brandy. This peaceable ſtate of affairs, however, was of no long continuance; the French took ſuch undue advantages of their ſuperiority over the ſavages, that they ſoon rekindled in the others that hatred which had never been entirely ſubdued. The ſavages, whoſe manner of life requires a vaſt extent of land, finding themſelves daily more and more ſtraitened, had recourſe to ſtratagem, in order to deſtroy their enemies. They ſeparated into ſmall bands, and way-laid the French as they came ſingly out into the woods to hunt, and, waiting till the ſportſman had diſcharged his piece, ruſhed upon and killed him before he could charge it again. Twenty men had been thus aſſaſſinated before any reaſon could be given for their ſudden diſappearance: but as ſoon as the matter was known, the French took a ſevere and fatal revenge; the ſavages were purſued and maſſacred, with their wives and children, and the few that eſcaped were driven out of Martinico, to which they never returned.

The French being thus left ſole maſters of the iſland, lived quietly on thoſe ſpots which beſt ſuited their inclination. At this time they were divided into two claſſes. The firſt conſiſted of thoſe who had paid their paſſage to the iſland, and theſe were called *inhabitants*; and to theſe the government diſtributed lands, which became their own, upon paying a yearly tribute. Theſe inhabitants had under their command a multitude of diſorderly people brought over from Europe at their expence, whom they called *engagés*, or bondſmen. This engagement was a kind of ſlavery for the term of three years; on the expiration of which they were at liberty, and became the equals of thoſe whom they had ſerved. They all confined themſelves at firſt to the culture of tobacco and cotton; to which was ſoon added that of arnotto and indigo. The culture of ſugar alſo was begun about the year 1650. Ten years after, one Benjamin D'Acoſta, a Jew, planted ſome cocoa trees; but his example was not followed till 1684, when chocolate was more commonly uſed in France. Cocoa then became the principal ſupport of the coloniſts, who had not a ſufficient fund to undertake ſugar plantations: but by the inclemency of the ſeaſon in 1718, all the cocoa-trees were deſtroyed at once.—Coffee was then propoſed as a proper object of culture. The French miniſtry had received, as a preſent from the Dutch, two of theſe trees, which were carefully preſerved in the king's botanical garden. Two young ſhoots were taken from theſe, put on board a ſhip for Martinico, and entruſted to the care of one Mr Deſclieux. The ſhip happened to be ſtraitened for want of freſh water; and the trees would have periſhed, had not the gentleman ſhared with

with them that quantity of water which was allowed for his own drinking. The culture of coffee was then begun, and attended with the greateſt and moſt rapid ſucceſs. About the end of laſt century, however, the colony had made but ſmall advances. In 1700, it had only 6597 white inhabitants. The ſavages, mulattoes, and free negroes, men, women, and children amounted to no more than 507. The number of ſlaves was but 14,566. All theſe together made a population of 21,645 perſons. The whole of the cattle amounted to 3668 horſes or mules, and 9217 head of horned cattle. The iſland produced a great quantity of cocoa, tobacco, and cotton; had nine indigo houſes, and 183 ſmall ſugar-plantations.

After the peace of Utrecht, Martinico began to emerge from that feeble ſtate in which it had ſo long continued. The iſland then became the mart for all the windward French ſettlements. In the ports of it the neighbouring iſlands ſold their produce, and bought the commodities of the mother-country; and, in ſhort, Martinico became famous all over Europe. In 1736, there were on the iſland 447 ſugar works; 11,953,232 coffee trees, 193,870 of cocoa; 2,068,480 plants of cotton, 39,400 of tobacco, 6750 of arnotto. The ſupplies for proviſion conſiſted of 4,806,132 banana trees; 34,483,000 trenches of caſſava; and 247 plots of potatoes and yams. The number of blacks amounted to 72,000 men, women, and children. Their labour had improved the plantations as far as was conſiſtent with the conſumption then made in Europe of American productions; and the annual exports from the iſland amounted to about 700,000 l.

The connections of Martinico with the other iſlands entitled her to the profits of commiſſion, and the charges of tranſport; as ſhe alone was in the poſſeſſion of carriages. This profit might be rated at the tenth of the produce; and the ſum total muſt have amounted to near 765,000l. This ſtanding debt was ſeldom called in, and left for the improvement of their plantations. It was increaſed by advances in money, ſlaves, and other neceſſary articles; ſo that Martinico became daily more and more a creditor to the other iſlands, and thus kept them in conſtant dependence; while they all enriched themſelves by her aſſiſtance.

The connections of this iſland with Cape Breton, Canada, and Louiſiana, procured a market for the ordinary ſugars, the inferior coffee, the molaſſes, and rum, which would not ſell in France. In exchange the inhabitants received ſalt-fiſh; dried vegetables, deals, and ſome flour. In the clandeſtine trade on the coaſts of Spaniſh America, conſiſting wholly of goods manufactured by the nation, ſhe commonly made a profit of 90 per cent. on the value of about 175,000l. ſent yearly to the Caraccas, or neighbouring colonies.

So many proſperous engagements brought immenſe ſums into Martinico. Upwards of 787,000 l. were conſtantly circulated in the iſland with great rapidity; and this is perhaps the only country in the world, where the ſpecie has been ſo conſiderable as to make it a matter of indifference to them whether they dealt in gold, ſilver, or commodities. This extenſive trade brought into the ports of Martinico annually 200 ſhips from France; 14 or 15 fitted out by the mother-country for the coaſt of Guinea, 60 from Canada, 10 or 12 from the iſlands of Margaretta and Trinidad; beſides the Engliſh and Dutch ſhips that came to carry on a ſmuggling trade. The private navigation from the iſland to the northern colonies, to the Spaniſh continent; and to the windward iſlands, employed 120 veſſels from 20 to 30 tons burden.

The war of 1744 put a ſtop to this proſperity. Not that the fault was in Martinico itſelf; its navy, conſtantly exerciſed, and accuſtomed to frequent engagements, which the carrying on of a contraband trade required, was prepared for action. In leſs than ſix months, 40 privateers, fitted out at St Peter's, ſpread themſelves about the latitude of the caribbee iſlands. They ſignalized themſelves in a manner worthy of the ancient free booters; returning conſtantly in triumph and laden with an immenſe booty. Yet, in the midſt of theſe ſucceſſes an entire ſtop was put to the navigation of the colony, both to the Spaniſh coaſt and to Canada. and they were conſtantly diſturbed even on their own coaſts. The few ſhips that came from France, in order to compenſate the hazards they were expoſed to by the loſs of their commodities, ſold them at a very advanced price, and bought them at a very low one. By this means the produce decreaſed in value, the lands were ill cultivated, the works neglected, and the ſlaves periſhing for want.

When every thing thus ſeemed tending to decay, the peace at laſt reſtored the freedom of trade, and with it the hopes of recovering the ancient proſperity of the iſland. the event however did not anſwer the pains that were taken to attain it. Two years had not elapſed after the ceſſation of hoſtilities, when the colony loſt the contraband trade ſhe carried on with the American Spaniards. This was owing to the ſubſtitution of regiſter-ſhips to the fleets; and thus were the attempts of the ſmugglers confined within very narrow bounds. In the new ſyſtem, the number of ſhips was undetermined, and the time of their arrival uncertain: which occaſioned a variation in the price of commodities unknown before; and from that time the ſmuggler, who only engaged in this trade from the certainty of a fixed and conſtant profit, would no longer purſue it, when it did not ſecure him an equivalent to the riſks he ran. But this loſs was not ſo ſenſibly felt by the colony, as the hardſhips brought upon them by the mother-country. An unſkilful adminiſtration clogged the reciprocal and neceſſary connection between the Iſlands and North-America with ſo many formalities, that in 1755 Martinico ſent but four veſſels to Canada. The direction of the colonies, now committed to the care of ignorant and avaricious clerks, ſoon loſt its importance, ſunk into contempt, and was proſtituted to venality. The debts which had been contracted, during a ſeries of calamities, had not yet been paid off, when the war broke out afreſh After a ſeries of misfortunes and defeats, the iſland fell into the hands of the Britiſh. It was reſtored, however, in July 1763, 16 months after it had been conquered; but deprived of all the neceſſary means of proſperity, that had made it of ſo much importance. For ſome years paſt, the contraband trade carried on to the Spaniſh coaſts was almoſt entirely loſt. The ceſſion of Canada had precluded all hopes of opening again a communication, which had only been interrupted by temporary miſtakes. The productions of the Grenades, St Vincent, and Dominica, which were now become Britiſh dominions, could no longer be brought into their harbours; and a new regulation of the mother-country, which forbad her having any intercourſe with Guadaloupe, left her no hopes from that quarter.

The colony, thus deprived of every thing as it were, and deſtitute, nevertheleſs contained, at the laſt ſurvey, which was taken on the firſt of January 1770, in the compaſs of 28 pariſhes, 12,450 white people of all ages and of both ſexes; 1814 free blacks or mulattoes; 70,553 ſlaves, and 444 fugitive negroes. The number of births in 1766, was in the proportion of one in 30 among the white people, and of one in 25 among the blacks. From this obſervation, if it were conſtant, it ſhould ſeem that the climate of America is much more favourable to the propagation of the Africans than of the Europeans; ſince the former multiply ſtill more in the labours and hardſhips of ſlavery, than the latter in the midſt of plenty and freedom. The conſequence muſt be, that in proceſs of time the increaſe of blacks in America will ſurpaſs that of the white men; and, perhaps, at laſt avenge this race of victims on the deſcendants of the oppreſſors.

The cattle of the colony conſiſts of 8283 horſes or mules; 12,376 head of horned cattle; 975 hogs; and 13,544 ſheep or goats.

Their proviſions are, 17,930,596 trenches of caſſava; 3,509,048 banana trees; and 406 ſquares and a half of yams and potatoes.

Their plantations contain 11,444 ſquares of land, planted with ſugar; 6,638,597 coffee-trees; 871,043 cocoa-trees; 1,764,807 cotton-plants; 59,966 trees of caſſia, and 61 of arnotto.

The meadows or ſavannahs take up 10,072 ſquares of land; there are 11,966 in wood, and 8444 uncultivated or forſaken.

The plantations which produce coffee, cotton, cocoa, and other things of leſs importance, are 1515 in number. There are but 286 for ſugar. They employ 116 water-mills, 12 wind-mills, and 184 turned by oxen. Before the hurricane of the 13th of Auguſt 1766, there were 302 ſmall habitations and 15 ſugar-works more.

In 1769, France imported from Martinico, upon 202 trading veſſels, 177,116 quintals of fine ſugar, and 12,579 quintals of raw ſugar; 68,518 quintals of coffee; 11,731 quintals of cocoa; 6048 quintals of cotton; 2518 quintals of caſſia; 783 caſks of rum; 307 hogſheads of molaſſes; 150 pounds of indigo; 2147 pounds of preſerved fruits; 47 pounds of chocolate; 282 pounds of raſped tobacco; 494 pounds of rope yarn; 334 cheſts of liqueurs: 234 hogſheads of molaſſes, &c. 451 quintals of wood for dyeing; and 12,108 hides in the hair. All theſe productions together have been bought in the colony itſelf, for 536,631l. 9s. 10. ſterl. It is true, that the colony has received from the mother-country to the amount of 588,412l. 16s. 6d. of merchandiſe; but part of this has been ſent away to the Spaniſh coaſts, and another part has been conveyed to the Engliſh ſettlements.

The iſland is 16 leagues in length and 45 in circumference, leaving out the capes, ſome of which extend two or three leagues into the ſea. It is very uneven, and interſected in all parts by a number of hillocks; which are moſtly of a conical form. Three mountains riſe above theſe ſmaller eminences. The higheſt bears the indelible marks of a volcano. The woods with which it is covered continually attract the clouds, which occaſions noxious damps, and contributes to make it horrid and inacceſſible; while the two others are in the moſt parts cultivated. From theſe mountains iſſue the many ſprings that water the iſland. Theſe waters, which flow in gentle ſtreams, are changed into torrents on the ſlighteſt ſtorm. Their qualities are derived from the ſoil over which they flow. In ſome places they are excellent, in others ſo bad, that the inhabitants are obliged to drink the water they have collected during the rainy ſeaſon.

Of all the French ſettlements in the Weſt Indies, Martinico is the moſt happily ſituated with regard to the winds which prevail in thoſe ſeas. Its harbours poſſeſs the ineſtimable advantage of affording a certain ſhelter from the hurricanes which annoy theſe latitudes. The harbour of Fort Royal is one of the beſt in all the windward iſlands; and ſo celebrated for its ſafety, that when it was open to the Dutch, their ſhipmaſters had orders from the republic to take ſhelter there in June, July, and Auguſt, the three months in which the hurricanes are moſt frequent. The lands of the Lamentin, which are but a league diſtant, are the richeſt and moſt fertile in the whole iſland. The numerous ſtreams which water this fruitful country, convey loaded canoes to a conſiderable diſtance from the ſea. The protection of the fortifications ſecured the peaceable enjoyments of ſo many advantages; which, however, were balanced by a ſwampy and unwholeſome ſoil. The capital of Martinico was alſo the rendezvous of the men of war; which branch of the navy has always oppreſſed the merchantmen. On this account, Fort Royal was an improper place to become the centre of trade, and was therefore removed to St Peter's. This little town, notwithſtanding the fires that have four times reduced it to aſhes, ſtill contains 1700 houſes. It is ſituated on the weſtern coaſt of the iſland, on a bay or inlet, which is almoſt circular. One part of it is built on the ſtrand along the ſea ſide, which is called the *anchorage;* and is the place deſtined for ſhips and ware-houſes. The other part of the town ſtands upon a very low hill: it is called the *Fort* from a ſmall fortification that was built there in 1665, to check the ſeditions of the inhabitants againſt the tyranny of monopoly; but it now ſerves to protect the road from foreign enemies. Theſe two parts of the town are ſeparated by a rivulet.

The anchorage is at the back of a pretty high and ſteep hill. Shut up as it were by this hill, which intercepts the eaſterly winds, the moſt conſtant and moſt ſalubrious in theſe parts: expoſed without any refreſhing breezes to the ſcorching beams of the ſun, reflected from the hill, from the ſea, and the black ſand on the beach; this place is extremely hot, and always unwholeſome. Beſides, there is no harbour; and the ſhips which cannot winter ſafely upon this coaſt are obliged to take ſhelter at Fort-Royal. But theſe diſadvantages are compenſated by the conveniency of the road of St Peter's, for loading and unloading of goods; and by its ſituation, which is ſuch that ſhips can freely go in and out at all times, and with all winds.

MARTLETS, in heraldry, little birds repreſented without feet; and uſed as a difference or mark of diſtinction for younger brothers, to put them in mind that they are to truſt to the wings of virtue and merit, in order to raiſe themſelves, and not to their feet, they having little land to ſet their foot on. See HERALDRY. Plate CCXXVII. fig. 1. A.

MARTYNIA, in botany: A genus of the angioſpermia order, belonging to the didynamia claſs of plants; and in the natural method ranking under the 10th order, *Perſonata*. The calyx is quinquefid, the corolla ringent, the capſule ligneous, covered with a bark, with a hooked beak, trilocular, and bivalved.—There are two ſpecies; both of them tender, herbaceous, flowery plants of South America; one of them an annual, the other a perennial, riſing with erect ſtalks, from a foot to two feet high, garniſhed with oblong ſimple leaves, and terminated by ſhort ſpikes of large monopetalous, bell-ſhaped flowers, of blue and purple colours. They flower in July and Auguſt, and are very ornamental, but require always to be kept in the hotteſt part of the ſtove.

MARTYR, is one who lays down his life, or ſuffers death, for the ſake of his religion. The word is Greek, μαρτυρ, and properly ſignifies "a witneſs." It is applied, by way of eminence, to thoſe who ſuffer in witneſs of the truth of the goſpel.

The Chriſtian church has abounded in martyrs, and hiſtory is filled with ſurpriſing accounts of their ſingular conſtancy and fortitude under the cruelleſt torments human nature was capable of ſuffering. The primitive Chriſtians were accuſed by their enemies of paying a ſort of divine worſhip to the martyrs. Of this we have an inſtance in the anſwer of the church of Smyrna to the ſuggeſtion of the Jews who, at the martyrdom of Polycarp, deſired the heathen judge not to ſuffer the Chriſtians to carry off his body, leſt they ſhould leave their crucified maſter, and worſhip him in his ſtead. To which they anſwered, "We can neither forſake Chriſt, nor worſhip any other; for we worſhip him as the Son of God; but love the martyrs as the diſciples and followers of the Lord, for the great affection they have ſhown to their King and Maſter." A like anſwer was given at the martyrdom of Fructuoſus in Spain. For when the judge aſked Eulogius, his deacon, Whether he would not worſhip Fructuoſus? as thinking, that tho' he refuſed to worſhip the heathen idols, he might yet be inclined to worſhip a Chriſtian martyr; Eulogius replied, "I do not worſhip Fructuoſus, but him whom Fructuoſus worſhips." The primitive Chriſtians believed, that the martyrs enjoyed very ſingular privileges, that upon their death they were immediately admitted to the beatific viſion, while other ſouls waited for the completion of their happineſs till the day of judgement: and that God would grant chiefly to their prayers the haſtening of his kingdom, and ſhortening the times of perſecution.

The churches built over the graves of the martyrs, and called by their names, in order to preſerve the memory of their ſufferings, were diſtinguiſhed by the title *martyrum confeſſio*, or *memoria*.

The feſtivals of the martyrs are of very ancient date in the Chriſtian church, and may be carried back at leaſt till the time of Polycarp, who ſuffered martyrdom about the year of Chriſt 168. On theſe days the Chriſtians met at the graves of the martyrs, and offered prayers and thankſgiving to God for the examples they had afforded them; they celebrated the euchariſt, and gave alms to the poor; which, together with a panegyrical oration or ſermon, and reading the acts of the martyrs, were the ſpiritual exerciſes of theſe anniverſaries.

Of the ſayings, ſufferings, and deaths of the martyrs, though preſerved with great care for the above purpoſe, and to ſerve as models to future ages, we have but very little left, the greateſt part of them having been deſtroyed during that dreadful perſecution which Diocleſian carried on for ten years with freſh fury againſt the Chriſtians; for a moſt diligent ſearch was then made after all their books and papers; and all of them that were found were committed to the flames. Euſebius, indeed, compoſed a martyrology, but it never reached down to us; and thoſe ſince compiled are extremely ſuſpected. From the eighth century downwards, ſeveral Greek and Latin writers endeavoured to make up the loſs, by compiling, with vaſt labour, accounts of the lives and actions of the ancient martyrs, but which conſiſt of little elſe than a ſeries of fables: Nor are thoſe records that paſs under the name of Martyrology worthy of ſuperior credit, ſince they bear the moſt evident marks both of ignorance and falſehood.

MARTYR (Peter), a famous divine, born at Florence in 1500. He ſtudied philoſophy and the tongues at Padua and Banonia, was a regular Auguſtine in the monaſtery of Fiſcoli, and was counted one of the beſt preachers in Italy. Zuinglius and Bucer's writings gave him a good opinion of the Proteſtants, and his converſation with Valdes confirmed it. He preached that doctrine at Rome in private; but, being impeached, fled to Naples, and thence to Lucca, where he brought over to the proteſtant intereſt Emanuel Tremelius, Celſus, Martinengas, Paul Laſicius, and Jeremiah Zanchy. He was ſent for to England by king Edward VI. and made profeſſor of divinity at Oxford in 1549. In Queen Mary's reign he returned to Straſburg, and was preſent at the conference of Poiſſy. His ſentiments were not the ſame with Calvin's about Chriſt's preſence in the euchariſt. He wrote a great number of works, and died in 1562.

MARTYROLOGY, a catalogue or liſt of martyrs, including the hiſtory of their lives and ſufferings for the ſake of religion. The term comes from μαρτυρ "witneſs," and λεγω *dico*, or λεγω *colligo*.

The martyrologies draw their materials from the kalenders of particular churches, in which the ſeveral feſtivals dedicated to them are marked; and which ſeem to be derived from the practice of the ancient Romans, who inſerted the names of heroes and great men in their faſti or public regiſters.

The martyrologies are very numerous, and contain many ridiculous and even contradictory narratives; which is eaſily accounted for, if we conſider how many forged and ſpurious accounts of the lives of ſaints and martyrs appeared in the firſt ages of the church, which the legendary writers afterwards adopted without examining into the truth of them. However, ſome good critics, of late years, have gone a great way towards

clearing

clearing the lives of the ſaints and martyrs from the monſtrous heap of fiction they laboured under. See the article LEGEND.

The martyrology of Euſebius of Cæſarea was the moſt celebrated in the ancient church. It was tranſlated into Latin by St Jerom; but the learned agree that it is not now extant. That attributed to Beda, in the eighth century, is of very doubtful authority; the names of ſeveral ſaints being there found who did not live till after the time of Beda. The ninth century was very fertile in martyrologies; then appeared that of Florus, ſubdeacon of the church at Lyons; who, however, only filled up the chaſms in Beda. This was publiſhed about the year 830, and was followed by that of Waldenburtus, monk of the dioceſe of Treves, written in verſe about the year 848, and this by that of Uſuard, a French monk, and written by the command of Charles the Bald in 875, which laſt is the martyrology now ordinarily uſed in the Romiſh church. That of Rabanus Maurus is an improvement on Beda and Florus, written about the year 845; that of Notker, monk of St Gal, was written about the year 894. The martyrology of Ado, monk of Ferrieres, in the dioceſe of Treves, afterwards archbiſhop of Vienne, is a deſcendant of the Roman, if we may ſo call it; for Du Sollier gives its genealogy thus: The martyrology of St Jerom is the great Roman martyrology; from this was made the little Roman one printed by Roſweyd; of this little Roman martyrology was formed that of Beda, augmented by Florus. Ado compiled his in the year 858. The martyrology of Nevelon, monk of Corbie, written about the year 1089, is little more than an abridgement of that of Ado; father Kircher alſo makes mention of a Coptic martyrology preſerved by the Maronites at Rome.

We have alſo ſeveral proteſtant martyrologies, containing the ſufferings of the reformed under the papiſts, viz. an Engliſh martyrology, by J. Fox; with others by Clark, Bray, &c.

MARTYROLOGY is alſo uſed, in the Romiſh church, for a toll or regiſter kept in the veſtry of each church, containing the *names* of all the ſaints and martyrs, both of the univerſal church and of the particular ones of that city or monaſtery.

MARTYROLOGY is alſo applied to the painted or written catalogues in the Romiſh churches, containing the foundations, obits, prayers, and maſſes, to be ſaid each day.

MARVELL (Andrew), an ingenious writer in the 17th century, was bred at Cambridge. He travelled thro' the moſt polite parts of Europe, and was ſecretary to the embaſſy at Conſtantinople. His firſt appearance in public buſineſs at home was as aſſiſtant to Mr John Milton Latin ſecretary to the protector. A little before the reſtoration, he was choſen by his native town, Kingſton upon Hull, to ſit in that parliament, which began at Weſtminſter April 25th 1660; and is recorded as the laſt member of parliament who received the wages or allowance anciently paid to repreſentatives by their conſtituents. He ſeldom ſpoke in parliament, but he had great influence without doors upon the members of both houſes; and prince Rupert had always the greateſt regard for his advice. He made himſelf very obnoxious to the government by his actions and writings; notwithſtanding which, king Charles II. took great delight in his converſation, and tried all means to win him over to his ſide, but in vain, nothing being ever able to ſhake his reſolution. There were many inſtances of his firmneſs in reſiſting the offers of the court; but he was proof againſt all temptations. The king having one night entertained him, ſent the lord-treaſurer Danby the next morning to find out his lodgings; which were then up two pair of ſtairs in one of the little courts in the Strand. He was buſy writing, when the treaſurer opened the door abruptly upon him. Surpriſed at the ſight of ſo unexpected a viſitor, Mr Marvell told his Lordſhip, "That he believed he had miſtaken his way." Lord Danby replied, "Not, now I have found Mr Marvell; telling him he came from his Majeſty, to know what he could do to ſerve him. Coming to a ſerious explanation, he told the lord-treaſurer, that he knew the nature of courts full well; that whoever is diſtinguiſhed by a prince's favour, is certainly expected to vote in his intereſt. The Lord Danby told him, that his Majeſty had only a juſt ſenſe of his merits, in regard to which he only deſired to know if there was any place at court he could be pleaſed with. Theſe offers, though urged with the greateſt earneſtneſs, had no effect upon him. He told the Lord-treaſurer, that he could not accept of them with honour; for he muſt be either ungrateful to the king in voting againſt him, or falſe to his country in giving into the meaſures of the court. The only favour therefore he had to requeſt of his Majeſty was, that he would eſteem him as dutiful a ſubject as any he had, and more in his proper intereſt by refuſing his offers than if he had embraced them. The Lord Danby finding no arguments could prevail, told him, that the king had ordered a thouſand pounds for him which he hoped he would receive till he could think what farther to aſk of his Majeſty. The laſt offer was rejected with the ſame ſtedfaſtneſs of mind as the firſt; though, as ſoon as the Lord-treaſurer was gone, he was forced to ſend to a friend to borrow a guinea. He died not without ſtrong ſuſpicions of his being poiſoned, in 1678, in the 58th year of his age. In 1688, the town of Kingſton upon Hull contributed a ſum of money to erect a monument over him in the church of St Giles in the Fields, where he was interred, and an epitaph compoſed by an able hand; but the miniſtry of that church forbid both the inſcription and monument to be placed there. He wrote many ingenious pieces; as, The Rehearſal tranſported; A ſhort hiſtorical Eſſay concerning General Councils, Creeds, and impoſitions in matters of religion, &c.; alſo Poems and Letters.

MARVEL of Peru, in botany. See MIRABILIS.

MARY, the mother of our Saviour Jeſus Chriſt, and a virgin at the time that ſhe conceived him; daughter of Joachim and of Anna, of the tribe of Judah, and married to Joſeph of the ſame tribe. The ſcripture tells us nothing of her parents, not ſo much as their names, unleſs Heli mentioned by St Luke iii. 23. be the ſame with Joachim. All that is ſaid concerning the birth of Mary and of her parents is only to be found in ſome apocryphal writings; which, however, are very ancient.

Mary was of the royal race of David, as was alſo her huſband; 'A virgin, eſpouſed to a man whoſe name was *Joſeph*, of the houſe of David,' ſays our tranſlation of St Luke i. 25. which tranſlation Mr Whitby thinks might be better rendered thus: ‘A virgin of the houſe of David, eſpouſed to a man whoſe name was *Joſeph*, and the virgin's name was *Mary*; becauſe this agrees better with the words of the angel, ‘The Lord ſhall give him the throne of his father David,’ ver. 32. For ſince the angel had plainly told the virgin, that ſhe ſhould have this ſon without the knowledge of any man, it was not Joſeph's but Mary's being of the houſe of David, that made David his father.

Mary was akin to the race of Aaron, ſince Elizabeth the wife of Zacharias was her couſin (ver. 36). Mary very early made a vow of chaſtity, and engaged herſelf to perpetual virginity. The *Proto-evangelium* of St James tells us, that ſhe was conſecrated to the Lord, and offered in the temple from her earlieſt youth; and that the prieſts gave her Joſeph for a ſpouſe, who was a holy and venerable old man, whom Providence appointed for this purpoſe by a miracle, the rod which he commonly carried having grown green and flouriſhed as Aaron's did formerly. He eſpouſed Mary, not to live with her in the ordinary uſe of marriage, and to have children by her, but only that he might be the guardian of her virginity. Though theſe circumſtances are not to be relied on as certain, yet Mary's reſolution of continency, even in a married ſtate, cannot be called in queſtion, ſince her virginity is atteſted by the goſpel, and that herſelf ſpeaking to the angel, who declared to her that ſhe ſhould become the mother of a ſon, told him that ‘ſhe knew not a man,’ (ver. 34.), or that ſhe lived in continency with her huſband: for which reaſon, when Joſeph perceived her pregnancy, he was extremely ſurpriſed at it, knowing the mutual reſolution they had agreed to of living in continence though in a ſtate of marriage.

When Mary was ready to lie in, an edict was publiſhed by Cæſar Auguſtus, which decreed, that all the ſubjects of the empire ſhould go to their own cities, there to have their names regiſtered according to their families. Thus Joſeph and Mary, who were both of the lineage of David, betook themſelves to the city of Bethlehem, from whence was the original of their families. But while they were in this place, the time being fulfilled in which Mary was to be delivered, ſhe brought forth her firſt-born ſon. She wrapped him in ſwaddling-clothes, and laid him in the manger of the ſtable or cavern whither they had retired: for they could find no place in the public inn, becauſe of the great concourſe of people that were then at Bethlehem on the ſame occaſion; or they were forced to withdraw into the ſtable of the inn, not being able to get a more convenient lodging, becauſe of the multitude of people then at Bethlehem.

At the ſame time the angels made it known to the ſhepherds who were in the fields near Bethlehem, and who came in the night to ſee Mary and Joſeph and the child lying in the manger, and to pay him their tribute of adoration. Mary took notice of all theſe things, and laid them up in her heart, (Luke ii. 19. Matth. ii. 8, 9, 10, 11, &c.). A few days after, the magi or wiſe men came from the eaſt, and brought to Jeſus the myſterious preſents of gold, frankincenſe, and myrrh; after which being warned by an angel that appeared to them in a dream, they returned into their own country by a way different from that by which they came. But the time of Mary's purification being come, that is 40 days after the birth of Jeſus, Mary went to Jeruſalem (Luke ii. 21.), there to preſent her ſon in the temple, and there to offer the ſacrifice appointed by the law for the purification of women after childbirth. There was then at Jeruſalem an old man named *Simeon*, who was full of the Holy Ghoſt, and who had received a ſecret aſſurance that he ſhould not die before he had ſeen Chriſt the Lord. He came then into the temple by the influence of the ſpirit of God, and taking the little Jeſus within his arms, he bleſſed the Lord: and afterwards addreſſing himſelf to Mary, he told her, ‘That this child ſhould be for the riſing and falling of many in Iſrael, and for a ſign which ſhould be ſpoken againſt; even ſo far as that her own ſoul ſhould be pierced as with a ſword, that the ſecret thoughts in the hearts of many might be diſcovered.’ Afterwards when Joſeph and Mary were preparing to return to their own country of Nazareth (Matth. ii. 13, 14), Joſeph was warned in a dream to retire into Egypt with Mary and the child, becauſe Herod had a deſign to deſtroy Jeſus. Joſeph obeys the admonition, and they continued in Egypt till after the death of Herod; upon which he and Mary returned to Nazareth, not daring to go to Bethlehem becauſe it was in the juriſdiction of Archelaus the ſon and ſucceſſor of Herod the great. Here the holy family took up their reſidence, and remained till Jeſus began his public miniſtry. We read of Mary being preſent at the marriage of Cana in Galilee, with her ſon Jeſus and his diſciples (John ii. 1, 2, &c.) On which occaſion Jeſus having turned water into wine, being the firſt public miracle that he performed, he went from thence to Capernaum with his mother and his brethren, or his parents and diſciples: and this ſeems to be the place where the holy virgin afterwards chiefly reſided. However, St Epiphanius thinks that ſhe followed him every where during the whole time of his preaching; though we do not find the evangeliſts make any mention of her among the holy women that followed him and miniſtered to his neceſſities. The virgin Mary was at Jeruſalem at the laſt paſſover that our Saviour celebrated there; ſhe ſaw all that was tranſacted againſt him, followed him to Calvary, and ſtood at the foot of his croſs with a conſtancy worthy of the mother of God. There Jeſus ſeeing his mother and his beloved diſciple near her, he ſaid to his mother, “Woman, behold thy ſon;” and to the diſciple, “Behold thy mother.” And from that hour the diſciple took her home to his own houſe. It is not to be doubted, but that our Saviour appeared to his mother immediately after his reſurrection; and that ſhe was the firſt, or at leaſt one of the firſt, to whom he vouchſafed this great conſolation. She was with the apoſtles at his aſcenſion, and continued with them at Jeruſalem, expecting the coming of the Holy Ghoſt (Acts i. 14.). After this, ſhe dwelt in the houſe of St John the Evangeliſt, who took care of her as of his own mother. It is thought that he took her along with him to Epheſus, where ſhe died in an extreme old age. There is a letter of the œcumenical council of Epheſus, importing, that in the fifth century it was believed ſhe was buried there. Yet this opinion was not ſo univerſal, but that there are authors of the ſame age who think ſhe died and was buried at Jeruſalem.

Mary (Magdalen), who has been generally confounded with Mary the ſiſter of Martha and Lazarus, but very improperly, was probably that ſinner mentioned by St Luke, chap. vii. 36, 37, &c. whoſe name he does not tell us. There are ſome circumſtances ſufficient to convince us, that ſhe is the ſame whom he calls *Mary Magdalen* in chap viii. 2. and from whom he ſays Jeſus drove out ſeven devils. Jeſus having healed the widow's ſon of Nain, entered into the city, and there was invited to eat by a Phariſee named *Simon*. While he was at table, a woman of a ſcandalous life came into the houſe, having an alabaſter box full of perfumed oil; and ſtanding upright behind Jeſus, and at his feet, for he was lying at table on a couch after the manner of the ancients, ſhe poured her perfume on his feet, kiſſed them, watered them with her tears, and wiped them with her hair. The Phariſee obſerving this, ſaid within himſelf, If this man were a prophet, he would know who this woman is that touches him, that ſhe is one of a wicked life. Then Jeſus, who knew the bottom of his heart, illuſtrated her caſe by a parable; and concluded with anſwering the woman, that her ſins were forgiven her. In the following chapter, St Luke tells us, that Jeſus, in company with his apoſtles, preached the goſpel from city to city; and that there were ſeveral women whom he had delivered from evil ſpirits, and had cured of their infirmities, among whom was Mary called *Magdalen*, out of whom went ſeven devils. This, it muſt be owned, is no poſitive proof that the ſinner mentioned before was Mary Magdalen; however, it is all we have in ſupport of this opinion: An opinion which has been ably controverted by others. Mary Magdalen had her ſurname, it is thought, from the town of Magdalia in Galilee. Lightfoot believes that this Mary is the ſame with Mary the ſiſter of Lazarus. Magdalen is mentioned by the evangeliſts among the women that followed our Saviour, to miniſter to him according to the cuſtom of the Jews. St Luke viii. 2. and St Mark xvi. 9. obſerve, that this woman had been delivered by Jeſus Chriſt from ſeven devils. This ſome underſtand in the literal ſenſe; but others take it figuratively, for the crimes and wickedneſs of her paſt life (ſuppoſing her to be the ſinner firſt abovementioned), from which Chriſt had reſcued her. Others maintain, that ſhe had always lived in virginity; and conſequently they make her a different perſon from the ſinner mentioned by St Luke: and by the ſeven devils of which ſhe was poſſeſſed, they underſtand no other than a real poſſeſſon, which is not inconſiſtent with a holy life. This indeed is the moſt probable opinion, and that which has been beſt ſupported. In particular, the author of a "Letter to Jonas Hanway" on the ſubject of Magdalen Houſe, publiſhed in 1758, has ſhown by a variety of learned remarks, and quotations both from the ſcriptures and from the beſt commentators, that Mary Magdalen was not the ſinner ſpoken of by Luke, but on the contrary that ſhe "was a woman of diſtinction, and very eaſy in her worldly circumſtances. For a while, ſhe had laboured under ſome bodily indiſpoſition, which our lord miraculouſly healed, and for which benefit ſhe was ever after very thankful. So far as we know, her conduct was always regular and free from cenſure; and we may reaſonably believe, that after her acquaintance with our Saviour it was edifying and exemplary. I conceive of her (continues our author) as a woman of a fine underſtanding, and known virtue and diſcretion, with a dignity of behaviour becoming her age, her wiſdom, and her high ſtation; by all which ſhe was a credit to him whom ſhe followed as her maſter and benefactor. She ſhowed our Lord great reſpect in his life, at his death, and after it; and ſhe was one of thoſe to whom he firſt ſhowed himſelf after his reſurrection."

Mary Magdalen followed Chriſt in the laſt journey that he made from Galilee to Jeruſalem, and was at the foot of the croſs with the holy virgin (John xix. 25. Mark. xv. 57.). After which ſhe returned to Jeruſalem to buy and prepare the perfumes, that ſhe might embalm him after the ſabbath was over which was then about to begin. All the ſabbath day ſhe remained in the city; and the next day early in the morning ſhe went to the ſepulchre along with Mary the mother of James and Salome (Mark xvi. 1, 2. Luke xxiv. 1, 2.). On the way, they inquired of one another, who ſhould take away the ſtone from the mouth of the the ſepulchre, and were ſenſible of a great earthquake. This was the token of our Saviour's reſurrection. Being come to his tomb, they ſaw two angels, who informed them that Jeſus was riſen. Upon this Mary Magdalen runs immediately to Jeruſalem, and acquaints the apoſtles with this good news, returning herſelf to the ſepulchre. Peter and John came alſo, and were witneſſes that the body was no longer there. They returned: but Mary ſtayed, and ſtooping forward to examine the inſide of the tomb, ſhe there ſaw two angels ſitting, one at the head and the other at the foot of the tomb; and immediately afterwards, upon turning about, ſhe beheld the Lord himſelf. She would have caſt herſelf at his feet to kiſs them. But Jeſus ſaid to her "Touch me not, for I am not yet aſcended to my Father." As if he had ſaid, "You ſhall have leiſure to ſee me hereafter; go now to my brethren, my apoſtles, and tell them, I am going to aſcend to my God and to their God, to my Father and to their Father.'. Thus had Mary the happineſs of firſt ſeeing our Saviour after his reſurrection. (See Math. xxviii. 5, &c. Mark xvi. 6, &c. John xx. 11, 17.)

She returned then to Jeruſalem, and told the apoſtles that ſhe had ſeen the Lord, that ſhe had ſpoken to him, and told them what he had ſaid to her. But at firſt they did not believe her, till her report was confirmed by many other teſtimonies.—This is what the goſpel informs us concerning Mary Magdalen, different from Mary the ſiſter of Martha, though ſhe has been often called by this name. For as to the pretended Hiſtory of Mary Magdalen, which is ſaid to have been written in Hebrew by Marcella ſervant of Martha; this can only relate to Mary ſiſter of Martha, and beſides is a mere piece of impoſture.

Mary, queen and tyrant of England, was eldeſt daughter of Henry VIII. by his firſt wife Catharine of Spain, and born at Greenwich in February 1557. Her mother was very careful of her education, and provided her with tutors to teach her what was fitting. Her firſt preceptor was the famous Linacre, who drew up for her uſe The Rudiments of Grammar, and afterwards *De emendata ſtructura Latina ſer-*

monis libri ſex. Linacre dying when ſhe was but ſix years old, Ludovicus Vives, a very learned man of Valenza in Spain, was her next tutor; and he compoſed for her *De ratione ſtudii puerilis*. Under the direction of theſe excellent men, ſhe became ſo great a miſtreſs of Latin, that Eraſmus commends her for her epiſtles in that language. Towards the end of her father's reign, at the earneſt ſolicitation of Queen Catharine Parr, ſhe undertook to tranſlate Eraſmus's Paraphraſe on the goſpel of St John; but being caſt into ſickneſs, as Udall relates, partly by overmuch ſtudy in this work, after ſhe had made ſome progreſs therein, ſhe left the reſt to be done by Dr Mallet her chaplain. This tranſlation is printed in the firſt volume of Eraſmus's Paraphraſe upon the New Teſtament, London, 1548, folio; and before it is a Preface, written by Udall, the famous maſter of Eton ſchool, and addreſſed to the queen dowager (A).—Had ſhe been educated in Spain, however, and an inquiſitor had been her preceptor, ſhe could not have imbibed more ſtrongly the bloody principles of Romiſh perſecution; and to the eternal diſgrace of the Engliſh prelacy, though the reformation had taken root in both univerſities, ſhe found Engliſh biſhops ready to carry her cruel deſigns to ſubvert it, into effectual execution. King Edward her brother dying the 6th of July 1553, ſhe was proclaimed queen the ſame month, and crowned in October by Stephen Gardiner biſhop of Wincheſter. Upon her acceſſion to the throne, ſhe declared, in her ſpeech to the council, that ſhe would not perſecute her Proteſtant ſubjects; but in the following month, ſhe prohibited preaching without a ſpecial licence; and before the expiration of three months, the Proteſtant biſhops were excluded the houſe of lords, and all the ſtatutes of Edward VI. reſpecting the Proteſtant religion were repealed. In July 1554, ſhe was married to Philip prince of Spain, eldeſt ſon of the emperor Charles V.; and now began that perſecution againſt the Proteſtants for which her reign is ſo juſtly infamous. Some have ſuppoſed, that the queen was herſelf of a compaſſionate and humane diſpoſition; and that moſt of thoſe barbarities were tranſacted by her biſhops without her knowledge or privity. Without her knowledge and privity they could not be: it would be a better defence of her to ſay, that a ſtrict adherence to a falſe religion, and a conſcientious obſervance of its pernicious and cruel dictates, over ruled and got the better of that goodneſs of temper which was natural to her. But neither can this plea be reaſonably admitted by any one, who conſiders her unkind and inhuman treatment of her ſiſter the Lady Elizabeth; her admitting a council for the taking up and burning of her father's body; her moſt ungrateful and perfidious breach of promiſe with the Suffolk men; her ungenerous and barbarous treatment of Judge Hales, who had ſtrenuouſly defended her right of ſucceſſion to the crown; and of Archbiſhop Cranmer, who in reality had ſaved her life. Shall we excuſe all this by ſaying, *Tantum religio potuit ſuadere malorum?* Her obligations to Cranmer deſerve to be more particularly ſet forth. Burnet ſays, "that her firm adherence to her mother's cauſe and intereſt, and her backwardneſs in ſubmitting to the king her father, were thought crimes of ſuch a nature by his majeſty, that he came to a reſolution to put her openly to death; and that when all others were unwilling to run any riſk in ſaving her, Cranmer alone ventured upon it. In his gentle way he told the king, "that ſhe was young and indiſcreet, and therefore it was no wonder if ſhe obſtinately adhered

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(A) As this preface contains many reflections which may very much edify the females of this age, we ſhall for their ſakes here tranſcribe a part to it. Mr Udall takes occaſion in it to obſerve to her majeſty, "The great number of noble women at that time in England, not only given to the ſtudy of human ſciences and ſtrange tongues, but alſo ſo thoroughly expert in the Holy Scriptures, that they were able to compare with the beſt writers, as well in enditing and penning of godly and fruitful treatiſes, to the inſtruction and edifying of realms in the knowledge of God, as alſo in tranſlating good books out of Latin or Greek into Engliſh, for the uſe and commodity of ſuch as are rude and ignorant of the ſaid tongues. It was now (he ſaid) no news in England to ſee young damſels in noble houſes, and in the courts of princes, inſtead of cards and other inſtruments of idle trifling, to have continually in their hands either pſalms, homilies, and other devout meditations, or elſe Paul's epiſtles, or ſome book of holy ſcripture matters, and as familiarly both to read or reaſon thereof in Greek, Latin, French, or Italian, as in Engliſh. It was now a common thing to ſee young virgins ſo trained in the ſtudy of good letters, that they willingly ſet all other vain paſtimes at nought for learning's ſake. It was now no news at all to ſee queens and ladies of moſt high eſtate and progeny, inſtead of courtly dalliance, to embrace virtuous exerciſes of reading and writing, and with moſt earneſt ſtudy, both early and late, to apply themſelves to the acquiring of knowledge, as well in all other liberal arts and diſciplines, as alſo moſt eſpecially of God and his holy word. And in this behalf (ſays he), like as to your highneſs, as well for compoſing and ſetting forth many godly pſalms, and divers other contemplative meditations, as alſo for cauſing theſe paraphraſes to be tranſlated into our vulgar tongue, England can never be able to render thanks ſufficient; ſo may it never be able, as her deſerts require, enough to praiſe and magnify the moſt noble, the moſt virtuous, the moſt witty, and the moſt ſtudious lady Mary's grace, for taking ſuch pain and travail in tranſlating this Paraphraſe of Eraſmus upon the goſpel of St John.—What could be a more plain declaration of her moſt conſtant purpoſe to promote God's word, and the free grace of his goſpel?" &c. Mr Udall was miſtaken; ſhe never meant any ſuch thing: for ſoon after her acceſſion to the throne, a proclamation was iſſued for calling in and ſuppreſſing this very book, and all others that had the leaſt tendency towards furthering the reformation. And Mr Walpole is of opinion, that the ſickneſs which came upon her while ſhe was tranſlating St John, was all affected; "for (ſays he) ſhe would not ſo eaſily have been caſt into ſickneſs, had ſhe been employed on the Legends of St Tereſa or St Catharine of Sienna."

to that which her mother and all about her had been infuſing into her for many years; but that it would appear ſtrange, if he ſhould for this cauſe ſo far forget the father, as to proceed to extremities with his own child; that if ſhe were ſeparated from her mother and her people, in a little time there might be ground gained on her; but that to take away her life, would raiſe horror through all Europe againſt him:" by which means he preſerved her.—Along with Archbiſhop Cranmer, who had thus ſaved her life, the biſhops Ridley and Latimer were alſo condemned for hereſy at Oxford, and afterwards burnt. In 1556, the perſecution became general; and Proteſtants of all ranks and ages, and of both ſexes, fell victims to papal fury. It is obſervable, likewiſe, that the ſame perfidious violation of promiſes and treaties prevailed in the queen's council, with reſpect to public affairs. By the treaty of marriage concluded between the queen and Philip, it was expreſsly ſtipulated that England ſhould not be engaged in any wars with France on account of Spain; yet in 1557, Philip, who had brought immenſe ſums of money into England, procured an offenſive and defenſive alliance againſt France, from the Engliſh adminiſtration, and 8000 of the queen's choiceſt troops were ſent over to the aſſiſtance of the Spaniards in the Low Countries: the loſs of Calais to the French was the firſt fruit of this war; and ſome aſſert, that upon this ſingle occaſion the queen ſhowed a ſtrong attachment to her native country, lamenting this ſtroke ſo deeply, that it occaſioned her death; but it is better authenticated, that ſhe was carried off by an epidemic fever, which raged ſo violently that it did not leave a ſufficient number of men in health to get in the harveſt. She had long, however, been, a prey if not to remorſe, yet to diſappointment and chagrin, ariſing from various croſs accidents, ſuch as want of children, and the abſence and unkindneſs of Philip conſequent thereupon. Her death happened Nov. 7. 1558, in the 43d year of her age, after a reign of five years, four months, and eleven days. There are ſome things of her writing ſtill extant. Strype has preſerved three prayers or meditations of hers: the firſt, "Againſt the aſſaults of vice;" the ſecond, "A meditation touching adverſity;" the third, "A prayer to be read at the hour of death." In Fox's "Acts and monuments" are printed eight of her letters to king Edward and the lords of the council, on her nonconformity, and on the impriſonment of her chaplain Dr Mallet. In the *Sylloge epiſtolarum* are ſeveral more of her letters, extremely curious: one of her delicacy in never having written but to three men; one of affection for her ſiſter; one after the death of Ann Boleyn; and one very remarkable of Cromwell to her. In "Haynes's State Papers," are two in Spaniſh, to the emperor Char. V.—There is alſo a French letter, printed by Strype from the Cotton library, in anſwer to a haughty mandate from Philip, when he had a mind to marry the lady Elizabeth to the duke of Savoy, againſt the queen's and princeſs's inclination: it is written in a moſt abject manner, and a wretched ſtyle.

Mary of Medicis, wife of Henry IV. king of France, was declared ſole regent of the kingdom in 1610, during the conſternation which the aſſaſſination of that beloved king had occaſioned. By her ambitious intrigues, the nation loſt all its influence abroad, and was torn to pieces at home by contending factions. After ſeveral viciſſitudes of fortune, ſhe was abandoned by her ſon Louis XIII. whoſe reign had been conſtantly diſturbed by the civil commotions ſhe had occaſioned; and died in indigence at Bruſſels, in 1642, aged 68. She built the ſuperb palace of Luxembourg at Paris, and embelliſhed that city with aqueducts and other ornaments.

Mary queen of Scotland, daughter of James V. was born in the royal palace of Linlithgow on the 8th of December 1542. Her mother was Mary, the eldeſt daughter of Claude duke of Guiſe, and widow of Louis duke of Longueville. Her father dying a few days after her birth, ſhe ſcarcely exiſted before ſhe was hailed queen.

The government of a queen was unknown in Scotland; and the government of an infant queen could not command much reſpect from martial and turbulent nobles, who exerciſed a kind of ſovereignty over their own vaſſals; who looked upon the moſt warlike of their monarchs in hardly any other light than as the chief of the ariſtocracy; and who, upon the ſlighteſt diſguſts, were ever ready to fly into rebellion, and to carry their arms to the foot of the throne.—James had not even provided againſt the diſorders of a minority, by committing to proper perſons the care of his daughter's education, and the adminiſtration of affairs in her name. The former of theſe objects, however, was not neglected, though the regency of the kingdom was entruſted to very feeble hands. At ſix years of age Mary was conveyed to France, where ſhe received her education in the court of Henry II. The opening powers of her mind, and her natural diſpoſitions, afforded early hopes of capacity and merit. After being taught to work with her needle and in tapeſtry, ſhe was inſtructed in the Latin tongue; and ſhe is ſaid to have underſtood it with an accuracy, which is in this age very uncommon in perſons of her ſex and elevated rank, but which was not then ſurpriſing, when it was the faſhion among great ladies to ſtudy the ancient languages. In the French, the Italian, and the Spaniſh tongues, her proficiency was ſtill greater, and ſhe ſpoke them with equal eaſe and propriety. She walked, danced, and rode with enchanting gracefulneſs; and ſhe was qualified by nature, as well as by art, to attain to diſtinction in painting, poetry, and muſic. To accompliſh the woman was not, however, the ſole object of her education. Either ſhe was taught, or ſhe very early diſcovered, the neceſſity of acquiring ſuch branches of knowledge as might enable her to diſcharge with dignity and prudence the duties of a ſovereign; and much of her time was devoted to the ſtudy of hiſtory, in which ſhe delighted to the end of her life.

Whilſt Mary reſided in the court of Henry II. her perſonal charms made a deep impreſſion on the mind of the Dauphin. It was in vain that the conſtable Montmorency oppoſed their marriage with all his influence. The importance of her kingdom to France, and the power of her uncles the princes of Lorraine, were more than ſufficient to counteract his intrigues; and the Dauphin obtained the moſt beautiful princeſs in Chriſtendom.

Though this alliance placed the queen of Scotland in the moſt conſpicuous point of view, in the politeſt court of Europe, and drew to her thoſe attentions which are in the higheſt degree pleaſing to a female mind in the gaiety of youth; it may yet be conſidered as having accidentally laid the foundation of the greateſt part of her future misfortunes. Elizabeth, who now ſwayed the ſceptre of England, had been declared illegitimate by an act of parliament: and though the Engliſh proteſtants paid no regard to a declaration which was compelled by the tyrannic violence of Henry VIII. and which he himſelf had indeed rendered null by calling his daughter to the throne after her brother and elder ſiſter; yet the papiſts both at home and abroad had objections to the legitimacy of Elizabeth's birth; founded on principles which with them had greater weight than the acts of any human legiſlature. Mary was unqueſtionably the next heir in regular ſucceſſion to the Engliſh throne, if Elizabeth ſhould die without legitimate iſſue; and upon her marriage to the Dauphin, ſhe was induced by the perſuaſion of her uncles, by the authority of the French king, and no doubt partly by her own ambition, to aſſume the title and arms of queen of England and Ireland. Theſe, indeed, ſhe forbore as ſoon as ſhe became her own miſtreſs; but the having at all aſſumed them was an offence which Elizabeth could never forgive, and which rankling in her boſom made her many years afterwards purſue the unhappy queen of Scots to the block.

Henry II. dying ſoon after the marriage of the Dauphin and Mary, they mounted the throne of France. In that elevated ſtation, the queen did not fail to diſtinguiſh herſelf. The weakneſs of her huſband ſerved to exhibit her accompliſhments to the greateſt advantage; and in a court where gallantry to the ſex, and the moſt profound reſpect for the perſon of the ſovereign were inſeparable from the manners of a gentleman, ſhe learned the firſt leſſons of royalty. But this ſcene of ſucceſsful grandeur and unmixed felicity was of ſhort duration. Her huſband Francis died unexpectedly, after a ſhort reign of ſixteen months. Regret for his death, her own humiliation, the diſgrace of her uncles the princes of Lorraine, which inſtantly followed, and the coldneſs of Catharine of Medicis the queen mother, who governed her ſon Charles IX. plunged Mary into inexpreſſible ſorrow. She was invited to return to her own kingdom, and ſhe tried to reconcile herſelf to her fate.

She was now to paſs from a ſituation of elegance and ſplendour to the very reign of incivility and turbulence, where moſt of her accompliſhments would be utterly loſt. Among the Scots of that period, elegance of taſte was little known. The generality of them were ſunk in ignorance and barbariſm; and what they termed religion, dictated to all a petulant rudeneſs of ſpeech and conduct, to which the queen of France was wholly unaccuſtomed. During her minority and abſence, the Proteſtant religion had gained a kind of eſtabliſhment in Scotland; obtained, indeed, by violence, and therefore liable to be overturned by an act of the ſovereign and the three eſtates in parliament. The queen, too, was unhappily of a different opinion from the great body of her ſubjects, upon that one topic, which among them actuated almoſt every heart, and directed almoſt every tongue. She had been educated in the church of Rome, and was ſtrongly attached to that profeſſion: Yet ſhe had either moderation enough in her ſpirit, or diſcretion enough in her underſtanding, not to attempt any innovation in the prevailing faith of proteſtaniſm. She allowed her ſubjects the full and free exerciſe of their new religion, and only challenged the ſame indulgence for her own. She contrived to attach to her, whether from his heart or only in appearance, her natural brother, the prior of St Andrew's; a man of ſtrong and vigorous parts, who, though he had taken the uſual oath of obedience to the pope, had thrown off his ſpiritual allegiance, and placed himſelf at the head of the reformers. By his means ſhe cruſhed an early and formidable rebellion; and in reward for his ſervices conferred upon him a large eſtate, and created him Earl of Murray. For two or three years her reign was proſperous, and her adminiſtration applauded by all her ſubjects, except the Proteſtant preachers; and had ſhe either remained unmarried, or beſtowed her affections upon a more worthy object, it is probable that her name would have deſcended to poſterity among thoſe of the moſt fortunate and moſt deſerving of Scottiſh monarchs.

But a queen, young beautiful, and accompliſhed, an ancient and hereditary kingdom, and the expectation of a mightier inheritance, were objects to excite the love and ambition of the moſt illuſtrious perſonages. Mary, however, who kept her eye ſteadily fixed on the Engliſh ſucceſſion, rejected every offer of a foreign alliance; and, ſwayed at firſt by prudential motives, and afterwards by love the moſt exceſſive, ſhe gave her hand to Henry Stuart, lord Darnley, the ſon of the earl of Lenox. This nobleman was, after herſelf, the neareſt heir to the crown of England; he was likewiſe the firſt in ſucceſſion after the earl of Arran to the crown of Scotland; and it is known that James V. had intended to introduce into his kingdom the Salique law, and to ſettle the crown upon Lenox in preference to his own daughter. Theſe conſiderations made Mary ſolicitous for an interview with Darnley; and at that interview love ſtole into her heart, and effaced every favourable thought of all her other ſuitors. Nature had indeed been laviſh to him of her kindneſs. He was tall of ſtature; his countenance and ſhapes were beautiful and regular; and, amidſt the maſks and dancing with which his arrival was celebrated, he ſhone with uncommon luſtre. But the bounty of nature extended not to his mind. His underſtanding was narrow; his ambition exceſſive; his obſtinacy inflexible; and under the guidance of no fixed principle, he was inconſtant and capricious. He knew neither how to enjoy his proſperity nor how to enſure it.

On the 29th of July 1565, this ill-fated pair were married; and though the queen gave her huſband every poſſible evidence of the moſt extravagant love; though ſhe infringed the principles of the conſtitution to confer upon him the title of king; and though ſhe was willing to ſhare with him all the offices, honours, and dignities of royalty—he was not ſatisfied with his lot, but ſoon began to clamour for more power. He had not been married ſeven months, when he entered into a conſpiracy to deprive Mary of the government, and to ſeat himſelf on her throne. With this view he

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headed a band of factious nobles, who entered her chamber at night; and though ſhe was then advanced in her pregnancy, murdered her ſecretary in her preſence, whilſt one of the ruffians held a cocked piſtol to her breaſt. Such an outrage, together with his infidelity and frequent amours, could not fail to alienate the affections of a high ſpirited woman, and to open her eyes to thoſe defects in his character which the ardor of love had hitherto prevented her from ſeeing. She ſighed and wept over the precipitation of her marriage: but though it was no longer poſſible to love him, ſhe ſtill treated him with attention and reſpect, and laboured to faſhion him to the humour of her people.

This was labour in vain. His prepoſterous vanity and aſpiring pride rouſed the reſentment and the ſcorn of the nobles: his follies and want of dignity made him little with the people. He deſerted the conſpirators with whom he had been leagued in the aſſaſſination of the ſecretary; and he had the extreme imprudence to threaten publicly the earl of Murray, who, from his talents and his followers, poſſeſſed the greateſt power of any man in the kingdom. The conſequence was, that a combination was formed for the king's deſtruction; and, on the 10th day of February 1567, the houſe in which he then reſided was early in the morning blown up with gun-powder, and his dead and naked body, without any marks of violence, was found in an adjoining field.

Such a daring and atrocious murder filled every mind with horror and aſtoniſhment. The queen, who had been in ſome meaſure reconciled to her huſband, was overwhelmed with grief, and took every method in her power to diſcover the regicides; but for ſome days nothing appeared which could lead to the diſcovery. Papers indeed were poſted on the moſt conſpicuous places in Edinburgh, accuſing the earl of Bothwell of the crime; and rumours were induſtriouſly circulated that his horrid enterpriſe was encouraged by the queen. Conſcious, it is to be preſumed, of her own innocence, Mary was the leſs diſpoſed to believe the guilt of Bothwell, who was accuſed as having only acted as her inſtrument; but when he was charged with the murder by the earl of Lenox, ſhe inſtantly orderd him on his trial. Through the management of the earl of Morton and others, who were afterwards diſcovered to have been partners in his guilt, Bothwell was acquitted of all ſhare and knowledge of the king's murder; and what is abſolutely aſtoniſhing, and ſhows the total want of honour at that time in Scotland, this flagitious man procured, by means of the ſame treacherous friends, a paper ſigned by the majority of the nobles, recommending him as a fit huſband for the queen!

Armed with this inſtrument of miſchief, which he weakly thought ſufficient to defend him from danger, Bothwell ſoon afterwards ſeized the perſon of his ſovereign, and carried her a priſoner to his caſtle at Dunbar. It has indeed been alleged by the enemies of the queen, that no force was employed on the occaſion; that ſhe was ſeized with her own conſent; and that ſhe was even privy to the ſubſcribing of the bond by the nobles. But it has been well obſerved by one of her ableſt vindicators (A), that "her previous knowledge of the bond, and her acquieſcence in the ſeizure of her perſon, are two facts in apparent oppoſition to each other. Had the queen acted in concert with Bothwell in obtaining the bond from the nobles, nothing remained but, under the ſanction of their unanimous addreſs, to have proceeded directly to the marriage. Inſtead of which, can we ſuppoſe her ſo weak as to reject that addreſs, and rather *chooſe* that Bothwell ſhould attempt to ſeize and carry her off by violence?—an attempt which many accidents might fruſtate, and which at all events could not fail to render him or both of them odious to the whole nation. Common ſenſe, then, as well as candour, muſt induce us to believe, that the ſcheme of ſeizing the queen was ſolely the contrivance of Bothwell and his aſſociates, and that it was really by force that ſhe was carried to Dunbar." Being there kept a cloſe priſoner for 12 days; having, as there is reaſon to believe, actually ſuffered the indignity of a rape; perceiving no appearance of a reſcue; and being ſhown the infamous bond of the nobles; Mary promiſed to receive her raviſher for a huſband, as in her opinion the only refuge for her injured honour. Without condemning with aſperity this compliance of the queen, it is impoſſible not to recollect the more dignified conduct which Richardſon attributes in ſimilar circumſtances to his Clariſſa; and every man who feels for the ſufferings, and reſpects the memory of Mary, muſt regret that ſhe had not fortitude to reſiſt every attempt to force upon her as a huſband the profligate and audacious villain who had offered her ſuch an inſult as no virtuous women ought ever to forgive. This, however, is only to regret that ſhe was not more than human; that ſhe who poſſeſſed ſo many perfections, ſhould have had them blended with one defect. "In the irretrievable ſituation of her affairs, let the moſt ſevere of her ſex ſay what courſe was left for her to follow? Her firſt and moſt urgent concern was to regain her liberty. That probably ſhe attained by promiſing to be directed by the advice of her council, where Bothwell had nothing to fear." The marriage, thus inauſpiciouſly contracted, was ſolemnized on the 15th of May 1567; and it was the ſignal for revolt to Morton, Lethington, and many of the other nobles, by whoſe wicked and relentleſs policy it had been chiefly brought about, and who had bound themſelves to employ their ſwords againſt all perſons who ſhould preſume to diſturb ſo deſirable an event.

As Bothwell was juſtly and univerſally deteſted, and as the rebels pretended that it was only againſt him and not againſt their ſovereign that they had taken up arms, troops flocked to them from every quarter. The progreſs and iſſue of this rebellion will be ſeen in our hiſtory of SCOTLAND: ſuffice it to ſay here, that upon the faith of promiſes the moſt ſolemn, not only of perſonal ſafety to herſelf, but of receiving as

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(A) *Tytler's Diſſertation on the Marriage of Queen Mary with the earl of Bothwell:* Tranſactions of the Society of Antiquaries of Scotland, Vol. I.

as much honour, ſervice, and obedience, as ever in any former period was paid by the nobility to the princes her predeceſſors, the unhappy queen delivered herſelf into the hands of her rebels, and perſuaded her huſband to fly from the danger which in her apprehenſion threatened his life. Theſe promiſes were inſtantly violated. The faithleſs nobles, after inſulting their ſovereign in the crueleſt manner, hurried her as a priſoner to a caſtle within a lake, were ſhe was committed to the care of that very woman who was the mother of her baſtard brother; who, with the natural inſolence of a whore's meanneſs, ſays Mr Whitaker, aſſerted the legitimacy of her own child and the illegitimacy of Mary; and who actually carried the natural vulgarity of a whore's impudence ſo far, as to ſtrip her of all her royal ornaments, and to dreſs her like a mere child of fortune in a coarſe brown caſſoc.

In this diſtreſs the queen's fortitude and preſence of mind did not forſake her: She contrived to make her eſcape from her priſon, and ſoon found herſelf at the head of 6000 combatants. This army, however, was defeated; and, in oppoſition to the advice and intreaties of all her friends, ſhe haſtily formed the reſolution of taking *refuge in England*. The archbiſhop of St Andrew's in particular accompanied her to the border; and when ſhe was about to quit her own kingdom, he laid hold on her horſe's bridle, and on his knees conjured her to return; but Mary proceeded, with the utmoſt reliance on the friendſhip of Elizabeth, which had been offered to her when ſhe was a priſoner, and of the ſincerity of which ſhe harboured not a doubt.

That princeſs, however, who had not yet forgotten her aſſumption of the title and arms of queen of England, was now taught to dread her talents and to be envious of her charms. She therefore, under various pretences, and in violation not only of public faith, but even of the common rights of hoſpitality, kept her a cloſe priſoner for 19 years; encouraged her rebellious ſubjects to accuſe her publicly of the murder of her huſband; allowed her no opportunity of vindicating her honour: and even employed venal ſcribblers to blaſt her fame. Under this unparalleled load of complicated diſtreſs, Mary preſerved the magnanimity of a queen, and practiſed with ſincerity the duties of a Chriſtian. Her ſufferings, her dignified affability, and her gentleneſs of diſpoſition, gained her great popularity in England, eſpecially among the Roman catholics; and as ſhe made many attempts to procure her liberty, and carried on a conſtant correſpondence with foreign powers, Elizabeth became at laſt ſo much afraid of her intrigues, that ſhe determined to cut her off, at whatever hazard. With this view ſhe prevailed upon her ſervile parliament to paſs an act which might make Mary anſwerable for the crimes of all who ſhould call themſelves her partizans; and upon that flagitious ſtatute ſhe was tried as a traitor concerned in the conſpiracy of Babington: (ſee SCOTLAND). Though the trial was conducted in a manner which would have been illegal even if ſhe had been a ſubject of England, and though no certain proof appeared of her connection with the conſpirators, ſhe was, to the amazement of Europe, condemned to ſuffer death.

The fair heroine received her ſentence with great compoſure; ſaying to thoſe by whom it was announced, "The news you bring cannot but be moſt welcome, ſince they announce the termination of my miſeries. Nor do I account that ſoul to be deſerving of the felicities of immortality which can ſhrink under the ſufferings of the body, or ſcruple the ſtroke that ſets it free." On the evening before her execution, for which, on the ſucceeding morn, ſhe prepared herſelf with religious ſolemnity and perfect reſignation, ſhe ordered all her ſervants to appear before her, and drank to them. She even condeſcended to beg their pardon for her omiſſions or neglects; and ſhe recommended it to them to love charity, to avoid the unhappy paſſions of hatred and malice, and to preſerve themſelves ſtedfaſt in the faith of Chriſt. She then diſtributed among them her money, her jewels, and her clothes, according to their rank or merit. She wrote her will with her own hand, conſtituting the duke of Guiſe her principal executor; and to the king and queen of France ſhe recommended her ſon, provided he ſhould prove worthy of their eſteem.—In the caſtle of Fotheringay ſhe was beheaded on the 8th of February 1587, in the 45th year of her age; and her body, after being embalmed and committed to a leaden coffin, was buried with royal pomp and ſplendor in the cathedral of Peterborough. Twenty years afterwards her bones were by order of her ſon and only child King James I. removed to Weſtminſter, and depoſited in their proper place among the kings of England.

The general character of Mary, which in the regular order of biography ſhould now be laid before the reader, has furniſhed matter of controverſy for 200 years. She is univerſally allowed to have had conſiderable talents, and a mind highly cultivated. By one party ſhe is painted with more virtues and with fewer defects than almoſt any other woman of the age in which ſhe lived. By another ſhe is repreſented as guilty of the groſſeſt crimes which a woman can commit—adultery and the murder of her huſband. By all it is confeſſed, that previous to her connection with the earl of Bothwell, her life as a Chriſtian was exemplary, and her adminſtration as a queen equitable and mild; and it has never been denied that ſhe bore her tedious ſufferings with ſuch reſignation and fortitude as are ſeldom found united with conſcious guilt. Theſe are ſtrong preſumptions of her innocence. The moral characters of men change by degrees; and it ſeems hardly conſiſtent with the known principals of human nature, that any perſon ſhould at once plunge deliberately from the ſummit of virtue to the depths of vice; or, when ſunk ſo low, ſhould by one effort recover his original ſtate of elevation. But in this controverſy preſumptions muſt go for nothing. The poſitive evidences which were brought againſt the queen of Scots are ſo concluſive, that if they be genuine ſhe muſt have been guilty: and if they be ſpurious, there can be no doubt of her innocence. They conſiſted of a box with letters, contracts, and ſonnets, ſaid to be writen by herſelf and ſent to the earl of Bothwell. In addition to theſe, the ſuppoſed confeſſions of the criminals who had ſuffered for the king's murder were originally urged as proofs of her guilt; but theſe confeſſions are now admitted by all parties to be either wholly forged, or ſo groſsly interpolated that no ſtreſs whatever can be laid upon them; and during Mary's life it was affirmed by her friends, and not ſufficiently contradicted by her enemies, that the perſons who had accuſed Bothwell, and were doubtleſs his accomplices, inſtead of criminating the queen, had openly proteſted her innocence in their dying moments.

Stuart's Hiſtory of Scotland.

The box then, with its contents, was the evidence upon which her accuſers had the chief and indeed the only reliance: and it is upon this evidence, whatever it be, that the guilt or innocence of the Scottiſh princeſs muſt finally be determined. It is uniformly affirmed upon the part of the earl of Murray and his faction, that the caſket with the letters and the ſonnets had been left by Bothwell in the caſtle of Edinburgh; that this nobleman, before he fled from Scotland, ſent a meſſenger to recover them; and that they were found in the poſſeſſion of this perſon. The 20th day of June 1567 is fixed as the date of this remarkable diſcovery. The governor of the caſtle at that time was Sir James Balfour. George Dalgleiſh, a ſervant of Bothwell's is named as his meſſenger upon this erand. He was ſeized, it is ſaid, by the domeſtics of the earl of Morton; and it was the earl of Morton himſelf who made the actual production of the caſket and its contents.

† Whitaker's Vindication.

This ſtory is unſupported by vouchers, contains improbabilities, and cannot be reconciled with hiſtory and events. There remains not any authentic or unſuſpicious evidence that the queen had diſhonoured the bed of Lord Darnley: and there is the moſt ſatisfactory evidence †, that though Bothwell was entruſted with the defence of the borders on account of his tried courage and loyalty, he was privately diſliked by Mary for his uncommon zeal in the cauſe of Proteſtantiſm. At the very time when the queen is ſaid to have had the moſt violent love for that nobleman, and with him to have been carrying on the moſt criminal intercourſe againſt her huſband, we know both from Randolph and from Knox, that Bothwell refuſed to gratify her by the ſmalleſt compliance with the ceremonies of her religion, though many of the other Proteſtant peers ſcrupled not to accompany her to the celebration of the maſs. That the villain who could deliberately commit murder, ſhould be ſo ſcrupulouſly conſcientious with reſpect to modes of faith and worſhip, as to ſtand forward with a *peculiar* ſtrain of bravery to oppoſe, in a favourite meaſure, the queen who was then admitting him to her bed, and actually *forming plans* for raiſing him to her throne, is ſurely, to ſay the leaſt of it, extremely improbable.

But let us ſuppoſe this non-compliance on the part of Bothwell to have been a meaſure concerted between the queen and him to conceal more effectually from the eyes of the public the criminal intercourſe in which they were engaged; is it not very ſurpriſing, that of ſuch politicians, the *one* ſhould have *written* thoſe letters, and the *other* have left them in the power of their *enemies*? The earl of Bothwell was expoſed, to more than ſuſpicions of a concern in the murder of the king. Theſe papers contained manifeſt proofs of his guilt. It evidently was not his intereſt to preſerve them: or admitting, that till his marriage was ſolemnized with the queen he might look upon them as his beſt ſecurity for the realiſing of his ambitious hopes, yet, after the event, when all his former friends had deſerted him, he muſt have felt the ſtrongeſt inducements to deſtroy ſuch a criminal correſpondence, and Mary muſt have been ardently animated with the ſame wiſh. The caſtle of Edinburgh, where the box is ſaid to have been lodged, was at this time entirely at their command; and Sir James Balfour their deputy, was the creature of Bothwell. If his enemies, who were now in arms againſt him, ſhould poſſeſs themſelves of this box and its contents, his deſtruction was inevitable. From his marriage till tbe 5th day of June, it was in his power to have deſtroyed the fatal papers; and if they had exiſted, it is not to be imagined that he would have neglected a ſtep ſo expedient, not only for his own ſecurity and reputation, but alſo for thoſe of the queen. During all this time, however, he made no effort to recover his box and letters; he had lodged them in the caſtle of Edinburgh; and there he choſe to leave them in the cuſtody of a man in whom he could not have one particle of affiance. This was exceſſively fooliſh; but his ſubſequent conduct was ſtill more ſo. Upon the 6th day of June, it is evident that he had reaſon to ſuſpect the fidelity of Sir James Balfour, ſince he avoided to take refuge in the caſtle of Edinburgh and fled to Dunbar. He returned, however, with an army in order to fight the rebels. The balance of empire might then ſeem to hang ſuſpended between himſelf and his enemies; and in that ſtate of things, a man of ſuch commodious principles as Balfour appears to have been, might be inclined to do his old friend and patron a ſecret ſervice, both to efface his former perfidy and to create himſelf a new intereſt with him in caſe he ſhould be victorious over the rebels. Yet in theſe critical moments Bothwell neglected to make any application to him for the caſket and the letters! On the 15th of June, all his towering imaginations were at once daſhed to the ground. He had come to Carberry-hill, followed by an army and accompanied by a queen; but he fled from it attended only by a ſingle ſervant, and was glad to ſhelter himſelf in the caſtle of Dunbar from the vengeance due to his crimes. Yet in this extremity of diſtreſs he is repreſented as trying a bold experiment, which he had not courage to try when he was fortified with the authority of his ſovereign, and when he was facing the rebels in the field. In the very hour when almoſt every friend had deſerted him, he expected a return of friendſhip from a man who had deſerted him at firſt only becauſe he *ſuſpected him to be in danger*. At this period he ſent his ſervant George Dalgleiſh to wait upon Balfour, the acting governor of the caſtle of Edinburgh, with a requiſition for the box of letters, and to bring back the important charge, through ten thouſand dangers, to Dunbar. Though this man was one of his agents in the murder of the king, and might therefore have been ſafely entruſted with any ſecret, he did not order him, as common ſenſe requires he ſhould have done, to deſtroy the letters as ſoon as he ſhould get them into his poſſeſſion. No! he ſent him to fetch them from the caſtle, as if there was no danger in going thither, no doubt of receiving them there, and no difficulty in carrying them back. † To a traveller in an eaſy chair, all roads are ſmooth, and all days are fine. Accordingly this ſame Dalgleiſh, though the well known ſervant of Bothwell, makes good his entrance at the gates of the city, though theſe were guarded by 450 harquebuſiers all hoſtile to his

† Whitaker's Vindication.

his maſter, finds his way to the caſtle, and delivers his meſſage. But what is more aſtoniſhing than all, he actually receives the box of letters from Sir James Balfour. This indeed, ſays mr Whitaker, is "o'er-doing Termagant; it out-herods Herod." Balfour was the ductile ſlave of ſelfiſhneſs. He had with infinite perfidiouſneſs turned againſt his friend, his patron, and his queen, only becauſe he ſaw them oppoſed by a party which he *thought* would prove too ſtrong for them; but now when they were both plunged into the loweſt ſtate of diſtreſs, and branded with the appellation of regicides, his ſelfiſhneſs was ſuddenly changed into generoſity, his meanneſs gave place to exalted ſentiments, and, at the peril of his own life, he performed an heroical act of kindneſs! "In ſuch circumſtances (aſks a contemporary writer), is it to be thought, either that the earl would ſend to the ſaid Sir James, or that the ſaid Sir James would ſend any thing to the earl? Is it likely? Is it credible?" No matter: Bothwell is made to ſend for his papers at a time when his difficulties and his deſpair render it *improbable* that he could *think* of them, and when it was abſolutely *impoſſible* that he could *recover* them. His meſſenger accordingly is intercepted with the caſket; and the adverſaries of the queen, upon the 20th day of June, became poſſeſſed of vouchers with which they might operate her deſtruction. Theſe inconſiſtencies are glaring, and of a force not eaſily to be controuled; and the ſtory is open to other objections, which are, if poſſible, greater, and altogether inſurmountable.

By comparing different proclamations of the rebels with the ſeveral diſpatches of Throgmorton, who was then Elizabeth's reſident in Scotland, Mr Whitaker has made it appear in the higheſt degree probable, that Dalgleiſh was *not* ſeized *till* the 17th of July; that he was then, in conſequence of an order iſſued by the court of ſeſſion, apprehended, together with Powrie, another of Bothwell's ſervants, in that nobleman's lodgings in the palace of Holyroodhouſe; and that therefore he could not be the bearer of the letters intercepted by the earl of Morton on the 20th of June. What adds greatly to this probability is the account which the rebels themſelves give of his examination. A few days after he was taken, he was examined, ſay they, judicially, in a council where the earls of Morton and Athol are marked as preſent. It was natural upon this occaſion to make inquiries about the caſket and the papers. No queſtions, however, were put to him on that ſubject. He was not confronted with Sir James Balfour, from whom he had received the caſket; nor with the domeſtics of the earl of Morton, by whom it was ſaid that he had been apprehended. He was kept in priſon many months after this examination; and during a period when the rebels were infinitely preſſed to apologize for their violence againſt the queen, there were opportunities without number of bringing him to a confeſſion. Theſe opportunities, hower, were avoided; and there exiſts not the ſlighteſt evidence that the caſket and the papers had ever been in his poſſeſſion. Is it then to be ſuppoſed, that if the caſket and the papers had really been diſcovered with *him*, the eſtabliſhment of a fact ſo important would have been neglected by the adverſaries of the queen? No! they would have eſtabliſhed it by the moſt complete evidence; which they were ſo far from attempting to do, that the earlieſt account which they give of their pretended ſeizure of the letters is dated *fifteen months* after the event itſelf, and nearly *nine months* after the death of Dalgleiſh. To have blazoned their diſcovery at the time they pretend it was made, might have been attended with very diſagreeable conſequences; for Dalgleiſh, who at his execution aſſerted the innocence of the queen, and actually charged the earls of Murray and Morton as the contrivers of the murder, might have found proof that the caſket could not poſſibly have been intercepted in his cuſtody.

The 20th of June 1567 is fixed as the æra of the diſcovery of the letters. If this diſcovery had been real, the triumph of the enemies of the queen would have been infinite. They would not have delayed one moment to proclaim their joy, and to reveal to her indignant ſubjects the fulneſs and the infamy of her guilt. They preſerved, however a long and a profound ſilence. It was not till the 4th of December 1567 that the papers received the firſt mark of notice or diſtinction; nor till the 16th of September 1568, that the earl of Morton was ſaid to have intercepted them with Dalgleiſh. From the 20th day of June to the 4th day of December, many tranſactions and events of the higheſt importance had taken place; and the moſt powerful motives that have influence with men had called upon them to publiſh their diſcovery. They yet made no production of the papers, and ventured not to appeal to them. In the proclamation which they iſſued for apprehending Bothwell, they inveigh againſt his guilt, and expreſs an anxious deſire to puniſh the regicides: yet though this deed was poſterior to the 20th of June, there is no aſſertion in it to the diſhonour of the queen; and it contains no mention of the box and the letters. An ambaſſador arrived in this interval from France, to inquire into the rebellion and the impriſonment of the queen; yet they apologized not for their conduct by communicating to him the contents of the caſket. To Throgmorton, who had inſtructions to act with Mary as well as with her adverſaries, they denied the liberty of waiting upon her at Lochleven, where ſhe was detained a cloſe priſoner; and they were earneſt to impreſs him with the idea that her love of Bothwell was incurable. He preſſed them on the ſubject of their behaviour to her. At different times they attempted formally to vindicate themſelves; and they were uniformly vehement on the topic of the love which ſhe bore to that nobleman. Yet they abſtained from producing the letters to him. "They even ſpoke of her to him with *reſpect* and *reverence*;" which ſurely they could not poſſibly have done had they been then in poſſeſſion of the letters. They were ſolicitous to divide the faction of the nobles who adhered to the queen; and there could not have been a meaſure ſo effectual for this end as the production of the caſket and its contents; yet they called no convention of her friends, to ſurpriſe and diſunite them with this fatal diſcovery. They flattered the Proteſtant clergy, attended aſſemblies of the church, inſtilled into them a belief of the queen's being guilty of murder and adultery, and incited Mr Knox to "inveigh againſt her vehemently in his ſermons, to perſuade extremities towards her, and (as Throgmorton continues) to threaten the great plague of God againſt the whole country and nation if ſhe ſhould be ſpared from her *condign puniſhment* ;" but they ventured not to excite the fury of theſe ghoſtly fathers by exhibiting to them the box and the letters. They compelled the queen to ſubſcribe a reſignation of her crown ; and then had the ſtrongeſt reaſon to be ſolicitous to juſtify this daring tranſaction. The box and the letters would have ſerved as a complete vindication of them : yet they neglected to take any notice of theſe important vouchers; and were contented with reſting on the wild and frivolous pretence that the queen, from ſickneſs and fatigue, was diſguſted with the care of her kingdom.

To the irrefragable proof of the forgery of the letters ariſing from their having been ſo long concealed, it has been replied, that the rebels could not produce them ſooner with any regard to their own ſafety. "† A conſiderable number of their fellow-ſubjects, headed by ſome of the moſt powerful noblemen in the kingdom, was combined againſt them. This combination they could not hope to break or to vanquiſh without aid either from France or England. In the former kingdom, Mary's uncles, the duke of Guiſe and the cardinal of Lorrain, were at that period all-powerful, and the king himſelf was devotedly attached to her. The loading the queen, therefore, with the imputation of being acceſſory to the murder of her huſband, would be deemed ſuch an inexpiable crime by the court or France, as muſt cut off every hope of countenance or aid from that quarter. From England, with which the principal confederates had been long and intimately connected, they had many reaſons to expect more effectual ſupport ; but to their aſtoniſhment, Elizabeth condemned their proceedings with aſperity. Her high notions of royal authority, and of the ſubmiſſion due by ſubjects, induced her on this occaſion to exert herſelf in behalf of Mary, not only with ſincerity but with zeal : ſhe negociated, ſhe ſolicited, ſhe threatened. From all theſe circumſtances the confederates had every reaſon to apprehend that Mary would ſoon obtain her liberty, and by ſome accommodation be reſtored to the whole, or at leaſt to a conſiderable portion, of her authotity as ſovereign; and *therefore* they were afraid of the conſequences of accuſing her publickly of crimes ſo atrocious as adultery and murder."

This apology for the rebels conſiſts of aſſertions for which there is no evidence, and of arguments which are wholly untenable. There is no evidence that Elizabeth exerted herſelf in behalf of Mary with ſincerity and with zeal. If ſhe had, ſhe would have done more than threaten. An Engliſh army of 5000 men, aided by the Scottiſh combination which continued faithful to the queen, would have overturned the rebel government in the ſpace of a month. It is inconceivable that the rebels were prevented by any apprehenſion of the queen's reſtoration from accuſing her of the crimes of murder and adultery ; for we learn from a diſpatch of Throgmorton's dated the 19th of July 1567, that "men of good regard did then boldly and overtly by their ſpeech, utter great rigour and extremity againſt their ſovereign ; ſaying, it ſhall not be in the power of any *within* this realm, neither *without*, to keep her from condign puniſhment for her notorious crimes." From another diſpatch of the ſame ambaſſador's, dated five days after the former, we learn, that through him they *actually did* accuſe her to Elizabeth of "incontinency, as well with the earl of Bothwell as with others, and likewiſe of the murder of her huſband, of which, they ſaid, they had as apparent proof againſt her as might be ; as well by the teſtimony of *her own hand-writing*, which they had recovered; as alſo by ſufficient witneſſes." This teſtimony, however, was not produced till more than four months afterwards ; a certain proof, that though it was now in the hands of the manufacturers, it was not yet ready for inſpection.

But let us take the facts of this ableſt antogoniſt of Mary as he had ſtated them, and conſider the argument which they are made to ſupport. It is apparent from the laſt quoted diſpatch of Throgmorton †, that it could not be unknown, either to the court of France or the court of England, that the rebels were at all events determined to crown the prince, and either to put the queen to death or to keep her a cloſe priſoner for life. Theſe deſperate enterpriſes, however, could not, it ſeems, be carried into effect without the countenance and aid of Elizabeth or Charles : but Elizabeth's notions of regal authority, and of the ſubmiſſion due by ſubjects, were high; and the French king was devotedly attached to the dethroned queen. If this was ſo, common ſenſe ſays, that the buſineſs of the confederates, ſince they expected aid from theſe princes, was to charge Mary at once with the murder and adultery, and ſupport the charge with the moſt convincing evidence which they had to produce. No ! ſays this apologiſt of theirs, Charles IX. would have conſidered ſuch conduct as a crime inexpiable, though he might *reaſonably* be expected to give them his countenance in putting to death, or keeping in perpetual priſon, for a comparatively venial offence, the queen to whom he was devotedly attached ! This is ſtrange reaſoning ; but it ſeems not to have occurred to the rebels themſelves. The letters made their firſt appearance in a ſecret council aſſembled by the earl of Murray on the 4th of December 1567; and the reaſon there aſſigned by the confederates for their unwillingneſs to produce them was, "That luif they beare unto hir perſon, wha ſometime was theire ſovereine, and for the reverrance of his majeſtie, whais moder ſhe is, as alſua the mony gude and excellent gifts and vertues quherewith God ſometimes indowit hir." And they proceed to ſay, that they would not have produced them at all, "gif otherwiſe the ſinceritie of their intentions and proceedings from the beginninge myht be known to forein nacions and the inhabitants of this ile (of whome mony yet remains in ſuſpence in judgment) ſatisfiet and reſolvit of the richtneſs of their quarrel, and the ſecuritie of them and theire poſteritie be ony other meane might be providit and eſtabliſhed." So far were they from dreaming that the production of the letters would injure their cauſe in the court of France, that we ſee they frankly acknowledged that the ſincerity and rectitude of their proceedings could not otherwiſe be manifeſted to foreign nations. In this inſtance they think and talk like reaſonable men ; but they do not long preſerve the ſame conſiſtency.

In this act of council the rebels diſcover the greateſt anxiety for their pardon and ſecurity : And "the

† Robertſon's Diſſertation, 13th edit.

† Whitaker

matter being largelie and with gude deliberacion reſſonit at great length, and upon ſundry daies; at laſt all the ſaid lords, baronnes, and others above expremit, can find no other way or moyen how to find or make the ſaid ſecuritie but the oppynynge and reveling of the truth and *grund of the hail matter fre the beginninge*, plainlie and uprightlie, &c. Therefore the lords of ſecrete council, &c. deſires it to be found and declarit be the eſtates and haill body of the parliament, that the cauſe and occaſion of the tacking of the queen's perſon upon the 15th daie of Junii laſt by paſt, and holding and detaining of the ſame within the hous and place of Lochlevin continewallie ſenſyne, preſentlie, and in *all tymes comyng*; and generally all other things *inventit*, ſpokin, writtin, or donne be them, or onny of them, ſen the tent daie of February laſt by paſt unto the daie and date *heirof*, towiching the ſaied queen hir perſon: that caus, and all things depending theiron, or that onie wiſe maie apperteine theireto, &c. was in the ſaied queen's awin default, in as far as be DIVERS HIR PRIVIE LETTERS WRITTEN AND SUBSRCIVIT WITH HIR AWIN HAND, and ſent by her to James Erll Bothwell, &c.—and be her ungodlie and diſhonourable proceedinge in a privait marriage, ſoddanlie and unproviſitly, it is moſt certain, that ſhe wasprevie, art and part, and of the actual deviſe and deid of the for-mencionit murther of the kinge, her lawchfull huſband, our ſovereine lorde's father, committit be the ſaid James Erll Bothwell, &c."

Had the letters been really genuine, into the abſurdity of this declaration no man of common ſenſe could poſſibly have fallen. Truth is always conſiſtent with itſelf; but in a ſeries of forgeries contradictions are ſcarcely avoidable. The confederates roſe in rebellion againſt the queen on the 10th of June; they faced her in rebellion at Carberrie-hill on the 15th; they ſent her away into priſon on the 16th: yet they afterwards juſtified *all* that they had done ſince the *tenth of February* by letters, which, they *ſaid*, they had not till the *twentieth of June!* "This (ſays Mr Whitaker), if we conſider it as folly, is one of the moſt ſtriking and eminent acts of folly that the world has ever beheld. But it ought to be conſidered in a light much more diſhonourable to the rebels; and as knavery, it is one of the rankeſt that has ever been attempted to be impoſed upon the ſons of men." On the 4th of December, it muſt be remembered that they had not fixed *any day* for the diſcovery of the letters. The ſtory of the ſeizure of Dalgleiſh with the caſket was not thought of till near a year afterwards; and when it was invented, they had certainly forgotten the date of their act of council. In that act, therefore, they were free to rove at large; but they roved very incautiouſly. By grounding upon the letters, proceedings prior to the 10th of June, they plainly declare the diſcovery of theſe fatal papers to have been *antecedent to the twentieth*. By grounding upon them their ſecret meſſages for ſedition, their private conventions for rebellion, and "every thing inventit, ſpokin, written, or done be them, or anny of them, reſpecting the queen, Bothwell, or Darnley, ſen the *tent daie of February* laſt by paſt," they even intimate the diſcovery to have been previous to the murder of the king; and yet by their own accounts ſome of the letters were then *actually unwritten*. This is aſtoniſhing; and ſhows the extreme difficulty of carrying to any length a conſiſtent ſeries of falſehoods. Even Murray, Morton, and Lethington, could not do it. They knocked down one ninepin in endeavouring to ſet up another; and they finally threw down all, making them mutually and ſucceſſively to ſtrike one another.

We have not yet done with this act of council. It was with a view to the approaching convention of the eſtates that it had been formed and managed. It was a preparation for the parliament in which the conſpirators had ſecured the fulleſt ſway, and where they propoſed to effectuate their pardon and ſecurity, and to eſtabliſh the letters as deciſive vouchers againſt the queen. Accordingly, upon the 15th day of Decmber 1567, the three eſtates were aſſembled. The conſpirators invited no candid or regular inveſtigation. The friends of the nation and of the queen were overawed. Every thing proceeded in conformity to the act of council. The conſpirators, by a parliamentary decree, received a full approbation of all the ſeverities which they had exerciſed againſt the queen. A pardon by anticipation was even accorded to them for any future cruelty they might be induced to inflict upon her.—The letters were mentioned as the cauſe of this ſingular law; and this new appeal to them may be termed the ſecond mark of their diſtinction. But, amidſt the plenitude of their power, the conſpirators called not the eſtates to a free and honeſt examination of them. This, indeed, had the letters been genuine, would have annihilated for ever all the conſequence of the queen. Upon this meaſure, however, they ventured not. The letters were merely produced in parliament, and an act founded on them; but the queen was not brought from her confinement to defend herſelf, nor was any advocate permitted to ſpeak for her. We learn from a paper of unqueſtionable authenticity †, that "ſindrie nobilmen that was her Grace's favouraris then preſent, buir with all (the rebel proceedings in this parliament), maiſt principellie for ſafety of hir Grace's lyfe, quhilk, or thair coming to parliament, was concludit and ſubſcryvit be ane greit part of hir takeris, to be taken fra hir in meiſt crewel manner, as is notourlie known." By the power of this magic, the friends of Mary were bound faſt. They durſt not venture to queſtion publicly the authenticity of the letters from their dread of expoſing the queen to the dagger of the aſſaſſin. The parliament, therefore, ſuſtained theſe forgeries as vouchers of her guilt, without ſcrutiny or debate of any kind. The conſpirators, who were themſelves the criminals, were her accuſers and her judges, and paſſed a law exactly in the terms in which the act of ſecret council had before drawn it up.

It was neceſſary to deſcribe both the letters in the act of council and in the ordination of parliament; and theſe deeds having fortunately deſcended to poſterity, it is apparent from a compariſon of them, that between the 4th and 15th days of December, the letters muſt have undergone very eſſential alterations under the management of the conſpirators. In the act of council the letters are deſcribed expreſsly as "written and *ſubſcrivit* with the queene's awin hand;" but in the act of parliament they are ſaid to be only "*written halilie* with hir awin hand," and there is no

† See Whitaker's Vindication.

intimation that they were *ſubſcribed* by her. Whence ariſes this difference? From a *blunder* in the clerk penning the act of council, ſays one: From a habit contracted by the ſame clerk, which made him *mechanically* add *ſubſcribed* to *written*, ſays another: From the *careleſſneſs* of the writer who tranſcribed the copy of the act of council which has deſcended to us, ſays a third. Theſe ſubterfuges have been expoſed in all their weakneſs by Meſſrs Tytler and Whitaker: but in this abſtract it is ſufficient to obſerve, that they are mere ſuppoſitions ſupported by no evidence; and that the copy of the act of council which we have was given to the miniſters of Elizabeth by the leaders of the faction, who were neither blundering clerks, nor under the habit of mechanically adding *ſubſcribed* to *writtten*. Under one form, therefore, the letters were certainly exhibited before the council, and under another form they were produced in parliament: but had they been genuine, they would have appeared uniformly with the ſame face. The clerk of the council was Alexander Hay, a notary public accuſtomed to draw up writings and to atteſt them; and what puts his accuracy with reſpect to the letters beyond all poſſibility of doubt, his deſcription of them is authenticated in the fulleſt manner by the ſignatures of Murray, Morton, and a long train of others who formed the ſecret council. The letters, therefore, were actually preſented to the ſecret council with the cuſtomary appendage of ſubſcription to them. But when theſe artificers of fraud came to reflect more cloſely on the approach of parliament, and to prepare their letters for the inſpection of the friends of Mary, they began to ſhrink at the thoughts of what they had done. To ſubſtantiate the charge by letters under her own hand, they had naturally annexed her own ſubſcription, a letter *unſubſcribed* being a ſoleciſm in evidence. But moſt unfortunately for the cauſe of *complete* forgery, Mary was ſtill in poſſeſſion of her own *ſeal*, and he who fabricated the letters was not an engraver. For this reaſon, "the allegit writings in form of miſſive letters or epiſtles," ſays the biſhop of Roſs, in an addreſs to Elizabeth, "are not *ſellit* nor *ſignetit*." They were neither atteſted by her ſubſcription at the bottom, nor ſecured by her ſeal on the outſide. In the ſecret council, where all were equally embarked in rebellion, theſe omiſſions were of no importance. But that letters containing intimations of adultery and of murder, ſhould be ſent by the queen to the earl of Bothwell, with her *ſubſcription* to them, and yet without any guard of a ſeal upon them, ſo far exceeds all the bounds of credibility, that they could not expect it to gain the belief of parliament. They were ſtruck with the abſurdity of their plan, and dreaded a detection. They were under the neceſſity of altering it; but they could not ſupply the defect of the ſeal. They, therefore, wrote over the letters anew, and withheld the ſubſcription.

Theſe letters were now as complete as the conſpirators wiſhed them; yet in this ſtate, while they were unſubſcribed and unſealed, they wanted other formalities which are uſual in diſpatches. They were without directions, and they had no dates. They muſt, therefore, have been ſent by the queen to Bothwell as *open* and *looſe papers*; yet they contained evidence againſt herſelf, and againſt him, of the moſt horrid wickedneſs; and Nicholas Hubert, the perſon who is ſaid to have carried moſt of them, was of the loweſt condition, and, as Dr Robertſon characterizes him, "a fooliſh talkative fellow." He would, therefore, ſurely *read* thoſe papers, which are polluted from end to end with open and uncovered adultery, and as ſurely *report* their contents to *others*. Theſe are the moſt incredible circumſtances, on the ſuppoſition that the letters are authentic, unleſs the queen was, what none of her enemies ever repreſented her, an abſolute idiot.

The letters in their compoſition bear no reſemblance to the other writings of the queen. They have a vulgarity, an indelicacy, and a coarſeneſs of expreſſion and manner, that by no means apply to her. They breathe nothing of the paſſion of love beſides the impulſes of the ſenſual appetite; and they repreſent a queen highly accompliſhed in love with one of her ſubjects, as acting with all the ſneaking humility of a cottager to a peer †. A few inſtances will ſhow this. "*The devil ſinder us*," ſhe is made to exclaim, "and God knit us togidder for ever for the maiſt faithful coupill that ever he unitit: *this is my feith; I will die in it*." "I am," ſhe ſays in another place, "varrey glad to wryte unto zow quhen the reſt are ſleipand; ſen I cannot ſleip as they do, and *as I wold deſyre*, that is, *in your armes*, my dear luſe." "Seeing to *obey* zow, my dear luſe, I ſpare *nouther honor, conſcience, haſarde, nor greatnes quhatſumever; tak it, I pray you, in gude part*, as from the maiſt faithful luifer that ever ze had, or ever ſall have." "Se not hir (his wife), quhais fenzeit teires ſuld not be ſa mikle preiſit nor eſtemit as the trew and faithful trevellis quhilk I ſuſtine for to *merite her place*." "God give zou, my only luſe, the hap and proſperitie quhilk your *humble* and faithful luſe deſyres unto zou, who *hopis to be ſchortly another thing to you* for the reward of my irkſome travelles." "When I will put you out of dout, and cleir myſelfe, *refuſe it not*, my dear luſe; and ſuffer me to make zou ſome pruſe be *my obedience*, my faithfulnes, conſtancie, and *voluntary ſubjection*, quhilk I tak for the *pleſandeſt gude* that I might reſſeif, *gif ze will eccept it*." "Such (ſays Mr Whitaker) was the coarſe *kirtle*, and the homely *neckatie*, in which theſe wretched repreſenters of Mary dreſſed themſelves up, for the exhibition of a queen dignified, refined, and elegant;—a queen whom, according to their own account, 'God had indowit with mony gude and excellent gifts and virtues!'"

† Whitaker

The evidence which points to the forgery of the letters is profuſe and inſtructive. In its ſeparate parts, it is powerful and ſatiſfactory ‡. When taken together, and in the union of its parts, it is invincible. But, amidſt all its cogency and ſtrength, there is a circumſtance moſt peculiarly in its favour, and of which it required no aid or aſſiſtance. By this peculiarity, it is caſed completely in ſteel, and armed at every point. The letters have come down to us in the French, the Scottiſh, and the Latin languages. Now the conſpirators affirmed, that they were written by the queen in the French language. But by a critical examination of them in theſe different languages, Mr Goodall demonſtrated, that the pretended French originals are a tranſlation from the Latin of Buchanan, which

‡ Stuart.

which is itſelf a verſion from the Scotch. This is indeed acknowledged by Dr Robertſon, the ableſt and moſt perſevering of all Mary's enemies, who pretends, that, ſo far as he knows, it never was denied. Determined, however, to ſupport the authenticity of the letters at all events, the ſame elegant and ingenious writer ſuppoſes ‡, that the French originals are now loſt, but that two or three ſentences of each of thoſe originals were retained, and prefixed to the Scottiſh tranſlation; and that the French editor obſerving this, fooliſhly concluded that the letters had been written partly in French and partly in Scottiſh. In ſupport of this ſingular hypotheſis, he proceeds to affirm, that "if we carefully conſider thoſe few French ſentences of each letter which ſtill remain, and apply to them that ſpecies of criticiſm by which Mr Goodall examined the whole, a clear proof will ariſe, that there was a French copy, not tranſlated from the Latin, but which was itſelf the original from which both the Latin and Scottiſh have been tranſlated." He accordingly applies this ſpecies of criticiſm, points out a few variations of meaning between what he calls the remaining ſentences of the original French and the preſent Latin; and thinks, that in the former he has diſcovered ſpirit and elegance which neither the Latin nor the Scottiſh have retained. His critical obſervations have been examined by Mr Whitaker; who makes it apparent as the noon-day ſun, that the Doctor has occaſionally miſtaken the ſenſe of the Latin, the French, and even the Scotch; and that he has *forgotten* to point out either the elegance or the ſpirit of any particular clauſes in his pretended originals. The ſame maſterly vindicator of Mary then turns his antagoniſt's artillery againſt himſelf; and demonſtrates, that ſuch varitiations as he has thought ſufficient to prove the exiſtence of a former French copy, are not confined to the firſt ſentence of each of the three firſt letters, but are extended to other ſentences, and diffuſed over all the letters. Hence he obſerves, that this mode of proving will demonſtrate the *preſent* French, and *every* ſentence in it, to that very original, which it primarily pretended to be, which Mr Goodall has ſo powerfully proved it not to be, and which even the Doctor himſelf dares not aſſert it is. Our limits will not admit of our tranſcribing the obſervations of theſe two illuſtrious critics; nor is it neceſſary that we ſhould tranſcribe them. By acknowledging that "Buchanan made his tranſlation, not from the French but from the Scottiſh copy (of which he juſtly obſerves, that were it neceſſary, ſeveral critical proofs might be brought)," Dr Robertſon, in effect, gives up his cauſe. Had there been any other French letters than the preſent †, what occaſion had Buchanan for the Scotch, when he himſelf muſt have had poſſeſſion of the originals? It is evident from Mr Anderſon's account, that thoſe letters were tranſlated by Buchanan in London during the time of the conferences. He was one of the aſſiſtants appointed to the rebel commiſſioners, and entruſted with the whole conduct of the proceſs againſt the queen. By him, with Lethington, Macgill, and Wood, the original letters were exhibited, and their contents explained to the Engliſh commiſſioners; and we know from the authentic hiſtory of thoſe papers, that they were neither loſt nor miſlaid for many years afterwards. It cannot be pretended that Buchanan did not underſtand the French; for he paſt moſt of his life in that country, and taught a ſchool there. He was, indeed, a daring zealot of rebellion; but, with all his audacity, he muſt have felt the taſk in which he was engaged a very ungracious one. When he ſat down to defame, in the eyes of all Europe, a queen to whom he owed not only allegiance but alſo perſonal gratitude, it is not conceivable that he could have tranſlated from a *Scotch tranſlation*, had he known any thing of a *French original*; and if the rebel commiſſioners, who were ſaid to produce them, knew nothing of ſuch originals, certainly nobody elſe ever did: if they exiſted not with Buchanan, they exiſted no where.

‡ Diſſertation.

†Tytler's Inquiry.

Dr Robertſon, however, has another argument againſt Mr Goodall, which he thinks concluſive. Of the eight letters "the five remaining (he ſays) never appeared in Latin; nor is there any proof of their ever being tranſlated into that language. Four of them, however, are publiſhed in French. This entirely overturns our author's hypotheſis concerning the neceſſity of a tranſlation into Latin."—An authentic fact will indeed overturn any hypotheſis; but, moſt unluckily for this argument, the Doctor advances the hypotheſis, and the fact reſts with Mr Goodall. It is indeed true that Buchanan *publiſhed* only the three firſt letters in Latin at the end of his detection; but it does not therefore follow, that the other five were never *tranſlated into that language*. Indeed Mr Whitaker has made it as apparent as any thing can be, that the whole eight were turned into Latin for the uſe of the French tranſlator, who, by his own account, underſtood not the Scotch. He has made it in the higheſt degree probable, that this tranſlator was one *Camuz*, a French refugee; and he has demonſtrated, that the tranſlation was made in London under the eye of Buchanan himſelf. We do not quote his arguments, becauſe they conſiſt of a great number of obſervations which cannot be abridged; and becauſe the tranſlator himſelf confeſſes every thing which is of importance to the cauſe maintained by Mr Goodall, "Au reſte (he tells us) epiſtras miſas ſur la ſin," *which were all but the eighth*, "avaient eſté eſcrites par la Royne, partie en Francois, partie en Eſcoſſois; et depuis traduictes ENTIEREMENT en LATIN: mais n'ayant cognoiſſance, de la langue Eſcoſſoiſe, j'ay mieux aimé exprimer TOUT ce, que j'ay trouve en LATIN, que," &c. "This confeſſion (ſays Mr Whitaker) takes a comprehenſive ſweep. It makes *all* the *ſeven* letters at leaſt, and the *whole* of *each*, to have been tranſlated into Latin, and from thence to have been rendered into French. It ſtarts no piddling objections about ſentences or half-ſentences, at the head or at the tail of any. It embraces all within its wide-ſpread arms. And it proves the fancied exiſtence of a French copy at the time to be all a fairy viſion; the creation of minds that have ſubjected their judgements to their imaginations; the invited dreams of ſelf-deluſion."

The letters, ſo weak on every ſide, and ſo incapable of ſuſtaining any ſcrutiny, give the marks of ſuſpicion and guilt in all the ſtages of their progreſs. Even with the parliamentary ſanction afforded to them by the three eſtates, which the earl of Murray aſſembled upon the 15th day of December 1567, he felt the delicacy to delicacy and the danger of employing them *openly* to the purpoſes for which they were invented. For while he was ſcheming with Elizabeth his accuſation of the queen of Scots, he took the precaution to ſubmit privately the letters to that princeſs by the agency of his ſecretary Mr Wood. The object of this ſecret tranſaction, which took place early in the month of June 1568, was the moſt flagitious, and preſſes not only againſt the integrity of Murray, but alſo againſt that of the Engliſh queen. Before he would advance with his charge, he ſolicited from her an aſſurance that the judges to be appointed in the trial of Mary would hold the letters to be true and probative.

By the encouragement of Elizabeth, the earl of Murray was prevailed upon to prefer his accuſation ||. He was ſoon to depart for England upon this buſineſs. A privy-council was held by him at Edinburgh. He took up in it with formality the letters of the queen from the earl of Morton, and gave a receipt for them to that nobleman. That receipt is remarkable and intereſting. It is dated upon the 16th day of September 1568, and contains the firſt mention that appears in hiſtory of the diſcovery of the letters as in the actual poſſeſſion of Dalgleiſh upon the 20th of June 1567. This, as we have already noticed, is a very ſuſpicious circumſtance; but it is not the only ſuſpicious circumſtance which is recorded in the receipt. In the act of ſecret-council, and in the ordination of parliament, in December 1567, when the earl of Murray and his aſſociates were infinitely anxious to eſtabliſh the criminality of the queen, the only vouchers of her guilt to which they appealed were the letters; and at that time, doubtleſs, they had prepared no other papers to which they could allude. But in Murray's receipt in September 1568, there is mention of other vouchers beſide the letters. He acknowledges, that he alſo received from the earl of Morton contracts or obligations, and ſonnets or love-verſes. Theſe remarkable papers, though ſaid to have been found upon the 20th of June 1567 appeared not till September 1568; and this difficulty is yet to be ſolved by thoſe who conceive them to be genuine. The general arguments which affect the authenticity of the letters apply to them in full force; only it muſt be obſerved, that as the original letters were undoubtedly in Scotch, the original ſonnets were as certainly written in French. This has been completely proved by Dr Robertſon, and is fully admitted by Mr Whitaker, who has made it in the higheſt degree probable that Lethington forged the letters and Buchanan the ſonnets. Be this as it may, the ſonnets have every external and internal evidence of forgery in common with the letters, and they have ſome marks of this kind peculiar to themſelves. In particular, they make the love of Mary ſtill more grovelling than the letters made it; and with a degree of meanneſs, of which the ſoul of Lethington was probably incapable, the author of the ſonnets has made the queen conſider it as "na lytill honor to be maiſtres of her ſubject's gudis!" In this the dignified princeſs is totally loſt in "the maid Marien" of her pretended imitators; and Buchanan, who in his commerce with the ſex was a mere ſenſualiſt, forgot on this occaſion that he was perſonating a lady and a queen.

|| Stuart.

There is, however, in theſe ſonnets, one paſſage of ſingular importance, which we muſt not paſs wholly unnoticed. The queen is made to ſay,

Pour luy auſſi j'ay jetté mainte larme,
Premier qu'il fuſt de ce corps poſſeſſeur,
Duquel alors il n'avoit pas le cœur.
Puis me donna un autre dur alarme,
Quand il verſa de ſon ſang mainte dragme.

For him alſo I powrit out mony teiris,
Firſt quhen he made himſelf poſſeſſour of this body,
Of the quhilk *then he had not the hart.*
Efter he did give me ane uther hard charge,
Quhen he bled of his blude greit quantitie, &c.

If theſe ſonnets could be ſuppoſed to be genuine, this paſſage would overthrow at once all the letters and both the contracts which were produced; and would prove, with the force of demonſtration, that the ſeizure of Mary by Bothwell was *not* with her own conſent; that he actually committed a *rape* upon her; that ſhe had for him *no love*; and that ſhe married him merely as a *refuge to her injured honour*. The ſonnets, however, are undoubtedly ſpurious; but, conſidered in this light, the verſes before us prove with equal force the full conviction in the minds of the rebels of what in an unguarded moment they actually confeſſed to Throgmorton, and was manifeſt to all the world: viz. that "the queen their ſovereign was *led captive*, and by FEAR, FORCE, and (as by many conjectures may be well ſuſpected) other EXTRAORDINARY and more UNLAWFUL means COMPELLED to become bedfellow to another wife's huſband." They prove likewiſe, that after the rape, finding Mary highly indignant at the brutality done her, Bothwell actually ſtabbed himſelf; not, we may believe, with any intention to take away his own life, but merely that by ſhedding many a "drachm" of blood he might mollify the heart of the queen.

But we mean not to purſue the hiſtory of the ſonnets any farther. Though they were undoubtedly invented in aid of the letters, to prove that fundamental principle of the conſpirators,—that the love of Mary to Bothwell was inordinate; yet they were ſo incompatible with hiſtory, and with one another, that they demonſtrate the ſpurioufneſs of themſelves, and of the evidence which they were intended to corroborate. By thus endeavouring to give an air of nature and probability to their monſtrous fictions, the rebels at once betrayed the fabrication of the whole. They have themſelves ſupplied us with a long and particular journal, to ſhow the true date of facts; and by that journal have their letters and their ſonnets been demonſtrated to be ſpurious. "The *makers* of theſe papers (ſays Mr Whitaker) have broken thro' all the barriers of their *own hiſtory*. They have ſtarted aſide from the *orbit* of *their own* chronology. They have taken a flight beyond the bounds of *their own* creation, and have there placed themſelves conſpicuous in THE PARADISE OF FOOLS."

This maſs of forgery was clandeſtinely ſhown to Elizabeth's commiſſioners during the conferences at York: (See SCOTLAND.) It was ſhown again to the ſame commiſſioners and others during the conferences at Weſtminſter. But neither Mary nor her commiſſioners could ever procure a ſight of a ſingle letter or a ſingle ſonnet. By the biſhop of Roſs and the Lord

Herries ſhe repeatedly demanded to ſee the papers ſaid to be written by her: but that requeſt, in itſelf reaſonable, Elizabeth, with an audacity of injuſtice of which the hiſtory of mankind can hardly furniſh a parallel, thought fit to refuſe. Mary then inſtructed her commiſſioners to demand *copies* of the letters and ſonnets; and offered even from theſe to demonſtrate in the preſence of the Engliſh queen and parliament, and the ambaſſadors of foreign princes, that the pretended originals were palpable forgeries. Even this demand was denied her; and there is undoubted evidence ſtill exiſting, that neither ſhe nor her commiſſioners had ſo much as a *copy* of theſe criminal papers till after thoſe important conferences had for ſome time been at an end. This laſt demand perplexed Elizabeth; the conferences were ſuddenly broken up; Murray was diſmiſſed with his box to Scotland; and the letters were ſeen no more!

But the letters, we are told, were at Weſtminſter compared with letters of the queen's, and found to be in the ſame Roman hand. They were indeed compared with other writings; but with what writings? This queſtion let Elizabeth's commiſſioners themſelves anſwer. They collated them, they ſay "with others her letters, which were ſhewed yeſternight, and avowed by THEM (the rebel commiſſioners) to be written by the ſaid queen." This was ſuch a collation as muſt have pronounced them to be idiots §, if we had not known them to be otherwiſe; and as ſuch as muſt pronounce them to be *knaves*, as we know them to have been men of ſenſe. Like perſons totally incompetent to the management of buſineſs, but in truth acting miniſterially in the works of profligacy, they compared the letters produced, NOT with letters furniſhed by Mary's commiſſioners, NOT with letters furniſhed even by indifferent perſons, BUT with letters *preſented by the producers themſelves*.--This (ſays Mr Whitaker) is ſuch an inſtance of impoſition upon Mary and the world, as can ſcarcely be paralleled in the annals of knavery. Many inſtances of impoſition, indeed, occur in the wretched hiſtory of our race; but we can hardly find one, in which the impoſition was ſo groſs, ſo formal, ſo important, and ſo clear. It was very groſs, becauſe it has not a ſhred of artifice to cover its ugly nakedneſs. It was very formal, becauſe it was done by men ſome of whom were of the firſt character in their country; and all were bound by honour, and tied down by oaths, to act uprightly in the buſineſs. It was very important, becauſe no leſs than the reputation of a queen, and the continuance of an uſurpation, depended upon it. And it is very clear, becauſe we have the fact related to us by the commiſſioners themſelves, recorded to their ſhame in their own journal, and tranſmitted by their own hands to poſterity with everlaſting infamy on their heads."

§ Whitaker

When Tytler's *Inquiry into the Evidence produced by the Earls of Murray and Morton againſt Mary Queen of Scots* was firſt publiſhed, it was reviewed in the Gentleman's Magazine by the late Dr Johnſon. The review, which conſiſts of a brief analyſis of the work, with reflections interſperſed on the force of the evidence, concludes thus:—"That the letters were forged is now made ſo probable, that perhaps they will never more be cited as teſtimonies." Subſequent experience has ſhown, that the great critic's knowledge of human nature had not deſerted him when he guarded his prediction with the word *perhaps*. Few authors poſſeſs the magnanimity of Fenelon; and it is not to be expected that he who once maintained the letters to be genuine, ſhould by reaſoning or criticiſm be compelled to relinquiſh them: but we are perſuaded, that, after the preſent generation of writers ſhall be extinct, theſe letters and ſonnets will never be cited as evidence, except of the profligacy of thoſe by whom they were fabricated. Having ſaid this, we leave the general character of Mary to the reflection of the reader (A).

She wrote, 1. Poems on various occaſions, in the Latin, French, and Scotch languages. One of her poems is printed among thoſe of A. Blackwood; another in Brantome's *Dames illuſtres*, written on the death of her firſt huſband Francis. 2. Conſolation of her long impriſonment and royal advice to her ſon. 3. A copy of verſes, in French, ſent with a diamond-ring to queen Elizabeth. There is a tranſlation of theſe verſes among the Latin poems of Sir Thomas Chaloner. 4. Genuine Letters of Mary queen of Scots, to James earl of Bothwell; tranſlated from the French, by E. Simonds; 1726. There are, beſides, many other of her epiſtles to queen Elizabeth, ſecretary Cecil, Mildmaye, &c. which are preſerved in the Cottonian, Aſhmolean, and other libraries.

MARY II. queen of England, eldeſt daughter of James II. by his firſt wife, was born at St James's in 1662. She was bred up a Proteſtant, and married to William Henry of Naſſau, then prince of Orange, afterward king of England, in the 16th year of her age. She ſtaid in Holland with her huſband till February 12. 1619, when ſhe came over, and was ſolemnly proclaimed queen of England, &c. She was an equal ſharer with her huſband in all the rights belonging to the crown; but the adminiſtration and execution thereof was lodged ſolely in the king. She was a princeſs endowed with the higheſt

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(A) This article ſtands in need of an apology; but whether for its length or ſhortneſs, our readers may perhaps differ in opinion. If it be conſidered as a piece of common biography, and compared with the limits which we have preſcribed to our other articles of the ſame kind, it has ſwelled to an extent beyond all proportion. But as a piece of common biography it ought not to be conſidered: it is intimately connected with the hiſtory of Scotland at a very intereſting period; and it has been juſtly obſerved, by one of the ableſt writers of the age, that "the fact under diſpute in the life of Mary, is a fundamental and eſſential one; and that, according to the opinion which the hiſtorian adopts with regard to it, he muſt vary and diſpoſe the whole of his ſubſequent narration." Viewed in this light, our abſtract of the evidence which has been urged on both ſides of this controverſy will by many be deemed too ſhort. To ſuch as wiſh for complete ſatisfaction we can only recommend the unbiaſſed ſtudy of the writings of *Buchannan*, *Leſlie* biſhop of Roſs, *Goodal*, *Robertſon*, *Hume*, *Tytler*, *Sir David Dalrymple*, *Stuart*, and *Whitaker*.

eſt perfections both of body and mind: ſhe loved hiſtory, as being proper to give her uſeful inſtructions; and was alſo a good judge as well as a lover of poetry. She ſtudied more than could be imagined, and would have read more than ſhe did if the frequent returns of ill-humours in her eyes had not forced her to ſpare them. She gave her minutes of leiſure to architecture and gardening; and ſince it employed many hands, ſhe ſaid ſhe hoped it would be forgiven her. She was the moſt gracious of ſovereigns to her ſubjects, and the moſt obliging of wives to her huſband, as well as the moſt excellent of miſtreſſes to her ſervants: ſhe ordered good books to be laid in the places of attendance, that perſons might not be idle while they were in their turns of ſervice. She was exceeding zealous for a reformation of manners; charitable in the higheſt degree, without the leaſt oſtentation. This excellent queen died on the 28th of December 1695; at Kenſington, of the ſmall-pox, in the 33d year of her age. In her the arts loſt a protectreſs, the unfortunate a mother, and the world a pattern of every virtue. As to her perſon ſhe was tall, of a majeſtic graceful mien, her countenance ſerene, her complexion ruddy, and her features beautiful.

Mary Magdalen's Day, a feſtival of the Romiſh church, obſerved on the 22d of July.

Mary-Greane's Houſe, a name given to Dunmore-head in the pariſh of Dunqueen, county of Kerry, and province of Munſter, in Ireland. It is the moſt weſtern point of all Europe, and called by the Iriſh *Ty Verney Geerone*. It is a point as much celebrated by them as John of Groat's-houſe by the Scots, which is the utmoſt extremity of North Britain.

MARYBOROUGH, a borough, market, and poſt town, and the aſſizes town to the Queen's county, in the province of Leinſter, in Ireland, ſo called in honour of Mary queen of England, who reduced this part of the country to ſhire-ground by act of parliament 6th and 7th Philip and Mary. It is governed by a burgo-maſter and bailiffs, and has a barrack for a troop of horſe. It returns two members to parliament, and has five fairs, It is diſtant from Dublin 40 miles.

MARYBURGH. See *Fort-William*.

MARYGOLD. See CALTHA.

Corn Marygold. See CHRYSANTHEMUM.

French Marygold. See TAYGETES.

MARYLAND, one of the United States of America. It received that name in honour of Henrietta Maria, the conſort of king Charles I. who made a grant of this country, with very extraordinary powers, to Lord Baltimore. It lies between 38 and 40 degrees north latitude, and in longitude from 74 to 78 degrees weſt from London. It is bounded on the north by Pennſylvania; on the eaſt by the Delaware ſtate; on the ſouth-eaſt and ſouth by the Atlantic Ocean, and a line drawn from the ocean over the peninſula (dividing it from Accomack county in Virginia) to the mouth of Patowmack river, thence up the Patowmack to its firſt fountain, thence by a due north line till it interſects the ſouthern boundary of Pennſylvania, in lat. 39° 43′ 18″; ſo that it has Virginia on the ſouth, ſouth-weſt, and weſt. It contains about 14000 ſquare miles, of which about one-ſixth is water. It is divided into 20 counties, 12 of which are in the weſtern and 8 on the eaſtern ſhore of Cheſapeak bay, viz. Harford, Baltimore, ditto town and precincts, Ann Arundel, Frederick, Allegany Waſhington, Montgomery, Prince George, Calvert, Charles, St Marys, Cecil, Kent, Qeen Ann, Caroline, Talbot, Somerſet, Dorcheſter, Worceſter. Each of theſe counties ſends four repreſentatives to the houſe of delegates, beſides which the city of Anapolis, and town of Baltimore,ſend each two.

The climate is generally mild and agreeable, ſuited to agricultural productions and a great variety of fruit-trees. In the interior hilly country the inhabitants are healthy; but in the flat country, in the neighbourhood of the marſhes and ſtagnant waters, they are, as in the other ſouthern ſtates, ſubject to intermittents. Cheſapeak bay divides this ſtate into the eaſtern and weſtern diviſions. It affords ſeveral good fiſheries; and, in a commercial view, is of immenſe advantage to the ſtate. It receives a number of the largeſt rivers in the United States. From the eaſtern ſhore in Maryland, among other ſmaller ones, it receives Pokomoke, Choptank, Cheſter, and Elk rivers; from the north the rapid Suſquehannah; and from the weſt Patapſco, Severn, Patuxent and Patomack, half of which is in Maryland and half in Virginia. Except the Suſquehannah and Patomack, theſe are ſmall rivers. Eaſt of the blue ridge of mountains, which ſtretches acroſs the weſtern part of this ſtate, the land, like that in all the ſouthern ſtates, is generally level and free of ſtones. Wheat and tobacco are the ſtaple commodities of Maryland. In the interior country, on the uplands, conſiderable quantities of hemp and flax are raiſed.

Wheat and tobacco are the ſtaple commodities. Tobacco is generally cultivated in ſets by negroes, in the following manner: The ſeed is ſown in beds of fine mould, and tranſplanted the begining of May. The plants are ſet at the diſtance of 3 or 4 feet from each other, and are hilled and kept continally free of weeds. When as many leaves have ſhot out as the ſoil will nouriſh to advantage, the top of the plant is broken off, which prevents its growing higher. It is carefully kept clear of worms, and the ſuckers, which put out between the leaves, are taken off at proper times till the plant arrives at perfection, which is in Auguſt. When the leaves turn of a browniſh colour, and begin to be ſpotted, the plant is cut down and hung up to dry, after having ſweat in heaps one night. When it can be handled without crumbling, which is always in moiſt weather, the leaves are ſtripped from the ſtalk, and tied in bundles, and packed for exportation in hogſheads containing 800 or 900 pounds. No ſuckers nor ground leaves are allowed to be merchantable. An induſtrous perſon may manage 6000 plants of tobacco, (which yield a 1000 lb.) and four acres of Indian corn.

Two articles are ſaid to be peculiar to Maryland, viz. the genuine *white* wheat, which grows in Kent, Queen Ann's, and Talbot counties, on the eaſtern ſhore, and which degenerates in other places—and the bright *kite's foot* tobacco, which is produced at Elkridge, on the Patuxent, on the Weſtern Shore.

Among other kinds of timber is the oak, of ſeveral kinds, which is of a ſtrait grain and eaſily rives into ſtaves, for exportation. The black walnut is in demand for cabinets, tables, and other furniture. The apples of this ſtate are large, but mealy; their peaches plenty and good. From theſe the inhabitants diſtil cyder, brandy, and peach brandy.

The number of inhabitants in this ſtate, including the negroes 319,728, which is nearly 23 for every ſquare mile. The inhabitants, except in the populous towns, live on their plantations, often ſeveral miles diſtant from each other. Mr Morſe obſerves, that to an inhabitant of the middle, and eſpecially of the eaſtern ſtates, which are thickly populated, they appear to live very retired and unſocial lives. The effects of this comparative ſolitude are viſible in the countenances, as well as in the manners and dreſs of many of the country people. You obſerve comparatively little of that cheerful ſprightlineſs of look and action which is the invariable and genuine offspring of ſocial intercourſe. Nor do you find that attention paid to dreſs, which is common, and which decency and propriety have rendered neceſſary, among people who are liable to receive company almoſt every day. Unaccuſtomed, in a great meaſure, to frequent and friendly viſits, they often ſuffer too much negligence in their dreſs. As the negroes perform all the mannual labour, their maſters are left to ſaunter away life in ſloth, and too often in ignorance. Theſe obſervations, however, muſt in juſtice be limited to the people in the country, and to thoſe particularly, whoſe poverty or parſimony prevents their ſpending a part of their time in populous towns, or otherwiſe mingling with the world. And with theſe limitations, they will equally apply to all the ſouthern ſtates. The inhabitants of the populous towns, and thoſe from the country who have intercourſe with them, are in their manners and cuſtoms genteel and agreeable.

That pride which grows on ſlavery, and is habitual to thoſe, who, from their infancy, are taught to believe and to feel their ſuperiority, is a viſible characteriſtic of the inhabitants of Maryland. But with this characteriſtic we muſt not fail to connect that of hoſpitality to ſtrangers, which is equally univerſal and obvious. Many of the women poſſeſs all the amiable, and many of the elegant accompliſhments of their ſex.

The chief towns in this ſtate are Anapolis and Baltimore.—*Anapolis*, the capital, and the wealthieſt town of its ſize in America, is ſituated juſt at the mouth of Severn river, 30 miles ſouth of Baltimore.—The houſes are generally large and elegant; and the ſtate-houſe is a noble building.—*Baltimore* has had the moſt rapid growth of any town on the continent. and is the fourth in ſize and fifth in trade in the United States. It lies in lat. 39. 21. on the north ſide of Patapſco river, around what is called the Baſon. The ſituation of the town is low. The number of houſes is about 2,300. The number of ſtores is near 300; and of churches 9, which belong to German Calviniſts and Lutherans, Epiſcopalians, Preſbyterians, Roman Catholics, Baptiſts, Methodiſts, Quakers, Nicolites, or New Quakers. The number of inhabitants appears by the cenſus to be 13,503. There are many very reſpectable families in Baltimore, who live genteelly, are hoſpitable to ſtrangers, and maintain a friendly and improving intercourſe with each other; but the bulk of the inhabitants, recently collected from almoſt all quarters of the world, bent on the purſuit of wealth, varying in their habits, their manners, and their religions, are leſs improved. The trade of Maryland is principally carried on from Baltimore, with the other ſtates, with the Weſt Indies, and with Europe. To theſe places they ſend annually large quantities of tobacco, wheat, flour, pig iron, lumber, and corn—beans, pork, and flaxſeed, in ſmaller quantities; and receive in return, dry goods, wines, ſpirits, ſugars, and other Weſt India commodities. The balance is generally in their favour.

Georgetown ſtands on the bank of the river Patomak, about 160 miles from its entrance into Cheſapeek Bay. The ground on which it ſtands is very broken, being a cluſter of little hills, which, though at preſent elevated conſiderably above the ſurface of the river, were probably, at ſome former period overflowed, as at the depth of 8 or 10 feet below the ſurface, marine ſhells have been found. Dr Martin, concludes an account of the climate and diſeaſes, of this town, in the following words—

"Upon the whole, Georgetown and its vicinity may be conſidered as a healthy part of America; and in any diſputes about the propriety of the ſeat of the general government being fixed here, no objection can be urged againſt it on account of its diſeaſes."

Fredericktown is a fine flouriſhing inland town of upwards of 300 houſes, built principally of brick and ſtone, and moſtly on one broad ſtreet. It is ſituated in a fertile country, about 4 miles ſouth of Catokton mountain and is a place of conſiderable trade. It has four places for public worſhip, one for Preſbyterians, two for Dutch Lutherans and Calviniſts, and one for Baptiſts; beſides a public gaol, and a brick market houſe.

Hagarſtown is but little inferior to Fredericktown, and is ſituated in the beautiful and well cultivated valley of Conegocheague, and carries on a conſiderable trade with the weſtern country.

Elkton is ſituated near the head of Cheſapeek bay, on a ſmall river which bears the name of the town. It enjoys great advantages from the carrying trade between Baltimore and Philadelphia. The tides ebb and flow to this town.

The city of Waſhington, in the territory of Columbia, was ceded by the ſtates of Virginia and Maryland, to the United States, and by them eſtabliſhed as the ſeat of their government, after the year 1800. This city, which is now building, ſtands at the junction of the rivers Patomak and the Eaſtern branch, latitude 38° 53′ North, extending nearly four miles up each, and including a tract of territory, exceeded, in point of convenience, ſalubrity, and beauty, by none, in America. For although the land in general, appears level, yet by gentle and gradual ſwellings, a variety of elegant proſpects are produced, and a ſufficient deſcent formed for carrying off the water occaſioned by rain. Within the limits of the city are a great number of excellent ſprings; and by digging wells, water of the beſt quality may readily be had. Beſides, the never failing ſtreams, that now run through that territory, may alſo be collected for the uſe of the city. The waters of Reedy branch, and of

Tiber creek, may be conveyed to the Preſident's houſe. The ſource of Tiber creek is elevated about 236 feet above the level of the tide in ſaid creek. The perpendicular height of the ground on which the capitol is to ſtand, is 78 feet above the level of the tide in Tiber creek. The water of Tiber creek, may, therefore, be conveyed to the capitol, and, after watering that part of the city, may be deſtined to other uſeful purpoſes.

The Eaſtern branch is one of the ſafeſt and moſt commodious harbours in America, being ſufficiently deep for the largeſt ſhips, for about four miles above its mouth, while the channel lies cloſe along the bank adjoining the city, and affords a large and convenient harbour.—The Patomak, although only navigable for ſmall craft, for a conſiderable diſtance from its banks next to the city (excepting about half a mile above the junction of the rivers) will nevertheleſs afford a capacious ſummer harbour; as an immenſe number of ſhips may ride in the great channel, oppoſite to, and below the city.

The Roman Catholics, who were the firſt ſettlers in Maryland, are ſtill numerous. Beſides theſe, there are Proteſtant Epiſcopalians, Engliſh, Scots, and Iriſh Preſbyterians, German Calviniſts, German Lutherans, Friends, Baptiſts, Methodiſts, and Nicolites, or New Quakers.—Seminaries of Learning, &c. Waſhington academy, in Somerſet county, was inſtituted by law in 1779. It was founded and is ſupported by voluntary ſubſcriptions and private donations, and is authorized to receive gifts and legacies, and to hold 2000 acres of land. A ſupplement to the law, paſſed in 1784, increaſed the number of truſtees from eleven to fifteen.

In 1782, a college was inſtituted at Cheſtertown, in Kent county, and was honoured with the name of WASHINGTON COLLEGE, after Preſident Waſhington. It is under the management of 24 viſitors or governors, with power to ſupply vacancies, and hold eſtates, whoſe yearly value ſhall not exceed 6000*l.* current money. By a law enacted in 1787, a permanent fund was granted to this inſtitution of 1250*l.* a year, currency, out of the monies ariſing from marriage licenſes, fines and forfeitures on the Eaſtern Shore.

St John's college was inſtituted in 1784, to have alſo 24 truſtees, with power to keep up the ſucceſſion by ſupplying vacancies, and to receive an annual income of 9000*l.* A permanent fund is aſſigned this college, of 1750*l.* a year, out of the monies ariſing from marriage licenſes, ordinary licenſes, fines and forfeitures on the Weſtern Shore. This college is to be at Annapolis, where a building is now prepared for it. Very liberal ſubſcriptions were obtained towards founding and carrying on theſe ſeminaries. The two colleges conſtitute one univerſity, by the name of 'the Univerſity of Maryland,' whereof the governor of the State, for the time being, is chancellor, and the principal of one of them, vice chancellor, either by ſeniority or by election, as may hereafter be provided for by rule or by law. The chancellor is empowered to call a meeting of the truſtees, or a repreſentation of ſeven of each, and two of the members of the faculty of each, (the principal being one) which meeting is ſtiled 'The Convocation of the univerſity of Maryland,' who are to frame the laws, preſerve uniformity of manners and literature in the colleges, confer the higher degrees, determine appeals, &c.

The Roman Catholics have alſo erected a college at Georgetown, on Patomak river, for the promotion of general literature.

In 1783, the Methodiſts inſtituted a college at Abington, in Harford county, by the name of Cokeſbury college, after Thomas Coke, and Francis Aſbury, biſhops of the Methodiſt Epiſcopal Church. The college edifice is of brick, handſomely built, on a healthy ſpot, enjoying a fine air, and a very extenſive proſpect.

The ſtudents, who are to conſiſt of the ſons of travelling preachers, the ſons of annual ſubſcribers, the ſons of the members of the Methodiſt ſociety and orphans, are inſtructed in the Engliſh, Latin, Greek, Logic, Rhetoric, Hiſtory, Geography, Natural Philoſophy and Aſtronomy; and when the finances of the college will admit, they are to be taught the Hebrew, French and German languages.

The college was erected and is ſupported wholly by ſubſcription and voluntary donations.

The ſtudents have regular hours for riſing, for prayers, for their meals, for ſtudy, and for recreation. They are all to be in bed preciſely at nine o'clock. Their recreations, (for they are to be 'indulged in nothing which the world calls *play*') are gardening, walking, riding, and bathing without doors; and within doors, the carpenters, joiners, cabinet-makers, or turners' buſineſs. Suitable proviſion is made for theſe ſeveral occupations, which are to be conſidered, not as matters of drudgery and conſtraint, but as pleaſing and healthful recreations, both for the body and mind. Another of their rules, which though new and ſingular, is favourable to the health and vigour of the body and mind, is, that the ſtudents ſhall not ſleep on feather beds, but on mattreſſes, and each one by himſelf. Particular attention is paid to the morals and religion of the ſtudents.

There are a few other literary inſtitutions, of inferior note, in different parts of the ſtate, and proviſion is made for free-ſchools in moſt of the counties; tho' ſome are entirely neglected, and very few carried on with any ſucceſs: ſo that a great proportion of the lower claſs of people are ignorant; and there are not a few who cannot write their names. But the revolution, among other happy effects, has rouſed the ſpirit of education, which is faſt ſpreading its ſalutary influences over this and the other ſouthern ſtates.

Conſtitution. The legiſlature is compoſed of two diſtinct branches, a ſenate and houſe of delegates, and ſtiled the General Aſſembly of Maryland. The ſenators are elected in the following manner: On the firſt of September, every fifth year, the freemen chooſe two men in each county to be electors of the ſenate, and one elector for the city of Annapolis, and one for the town of Baltimore. Theſe electors muſt have the qualifications neceſſary for county delegates. Theſe electors meet at Annapolis, or ſuch other place as ſhall be appointed for convening the legiſlature, on the third Monday in September, every fifth year, and elect by ballot 15 ſenators out of their own body or from the people at large. Nine of theſe muſt be reſidents on the weſtern ſhore, and ſix on the eaſtern: they muſt be more than twenty five years of age—muſt have reſided in the ſtate more than three years next preceding the election, and have real and perſonal property above the value of a thouſand pounds, the ſenate may originate any bills, except money bills, to which they can only give their aſſent or diſſent. The ſenate chuſe their preſident by ballot. The houſe of delegates is compoſed of four members for each county, choſen annually the firſt Monday in October. The city of Annapolis and town of Baltimore ſend each two delegates. The qualifications of a delegate, are, full age, one year's reſidence in the county where he is choſen, and real and perſonal property above the value of five hundred pounds. Both houſes chooſe their own officers and judge of the election of their members. A majority of each is a quorum. The election of ſenators and delegates is *viva voce*, and ſheriffs the returning officers, except in Baltimore town, where the commiſſioners ſuperintend the elections and make returns. The ſtated ſeſſion of the legiſlature is on the firſt Monday in November. The qualifications of a freeman are full age, a freehold eſtate of fifty acres of land, and actual reſidence in the county where he offers to vote—property to the value of thirty pounds in any part of the ſtate, and a year's reſidence in the county where he offers to vote.

On the ſecond Monday in November annually, a governor is appointed by the joint ballot of both houſes, taken in each houſe reſpectively, and depoſited in a conference room; where the boxes are examined by a joint committee of both houſes, and the number of votes ſeverally reported. The governor cannot continue in office longer than three years ſucceſſively, nor be re-elected until the expiration of four years after he has been out of office. The qualifications for the chief magiſtracy, are twenty five years of age, five years reſidence in the ſtate, next preceding the election, and real and perſonal eſtate above the value of five thouſand pounds, one thouſand of which muſt be freehold eſtate. On the ſecond Tueſday of November, annually, the ſenators and delegates elect by joint ballot, five able and diſcreet men, above twenty five years of age, reſidents in the ſtate three years next preceding the election, and poſſeſſing a freehold of lands and tenements above the value of a thouſand pounds, to be a council for aſſiſting the governor in the duties of his office. Senators, delegates and members of council, whilſt ſuch, can hold no other office of profit, nor receive the profits of any office exerciſed by another. The governor with the advice of his council, appoints the chancellor, all judges and juſtices, the attorney general, naval and militia officers, regiſters of the land office, ſurveyors, and all other civil officers, except conſtables, aſſeſſors and overſeers of the road. A court of appeals is eſtabliſhed for the final determination of all cauſes, which may be brought from the general court of admiralty, or of chancery.

Maryland was granted, as has been already noticed, by king Charles I. to Cecilius Calvert, baron of Baltimore in Ireland, June 20, 1632. The government of the province was by charter veſted in the proprietary; but it appears that he either never exerciſed theſe powers alone, or but for a ſhort time. The honourable Leonard Calvert, Eſq. Lord Baltimore's brother, was the firſt governor or lieutenant-general. In 1638, a law was paſſed, conſtituting the firſt regular houſe of aſſembly, which was to conſiſt of ſuch repreſentatives, called *burgeſſes*, as ſhould be elected purſuant to writs iſſued by the governor. Theſe burgeſſes poſſeſſed all the powers of the perſons electing them; but any other freemen, who did not aſſent to the election, might take their ſeats in perſon. Twelve burgeſſes or freemen, with the lieutenant-general and ſecretary, conſtituted the aſſembly or legiſlature. This aſſembly ſat at St Mary's, one of the ſouthern counties, which was the firſt ſettled part of Maryland, In 1689 the government was taken out of the hands of Lord Baltimore by the grand convention of England. Mr Copley was appointed governor by commiſſion from William and Mary in 1692, when the Proteſtant religion was eſtabliſhed by law. In 1716, the government of this province was reſtorto the proprietary, and continued in his hands till the late revolution; when, being an abſentee, his property in the lands was confiſcated, and the government aſſumed by the freemen of the province, who formed the conſtitution now exiſting. At the cloſe of the war, Henry Harford, Eſq; the natural ſon and heir of Lord Baltimore, petitioned the legiſlature of Maryland for his eſtate: but his petition was not granted. Mr Harford eſtimated his loſs of quit-rents, valued at 20 years purchaſe, and including arrears, at L.259,488, 5s.—dollars at 7s. 6d. and the value of his manors and reſerved lands at 327,441 of the ſame money.

MARYPORT, a ſea-port town of Cumberland, ſituated at the mouth of the Elne. It has a good harbour; and has 70 or 80 ſail of ſhipping from 30 to 250 tons burden, principally employed in the coal-trade; ſome of them ſail up the Baltic for timber, flax, iron, &c. They have a furnace for caſt-iron and a glaſs-houſe. A chapel was erected here in 1760.

MAS (Lewis du), natural ſon to Jean Louis de Montcalm Seigneur de Candiac, and a widow of rank of Rouergue, was born at Nimes in 1676. His firſt attention was beſtowed on juriſprudence; but afterwards he was altogether occupied with mathematics, philoſophy, and the ſtudy of the languages. Father Mallebranche cultivated his acquaintance and eſteemed his virtues. His firſt appearance was ſevere, his general temper tranquil; yet he had a lively and fertile imagination. His mind was active, full of reſources, and methodical. We are indebted to his induſtry for the Typographical Bureau. This invention is the more ingenious, as it preſents the tedious parts of education, namely, reading, writing, and the elements of languages, to the youthful mind as a delightful entertainment, and many people in France both in the capital and in the provinces have adopted it with ſucceſs. After he had conceived the idea of this invention, he made the firſt trial of it on the young Candiac, who was remarkable for his underſtanding in his earlieſt years. Du Mas conducted his pupil to Paris and the principal cities of France, where he was univerſally admired. This prodigy was carried off in the year 1726 before he was ſeven years of age, and his loſs had nearly deprived Du Mas of his reaſon. A dangerous illneſs was the conſeqnence of his vexation; and he would have died of want, if a gentleman had

had not taken him from his garret and entertained him in his own houſe. Du Mas afterwards retired with Madame de Vanjour within two leagues of Paris, and died in the year 1774, aged 68. He was a philoſopher both in genius and character. His works are, 1. *L'Art de tranſpoſer toutes ſortes de Muſiques ſans etre obligé de connoitre, ni le temps ni le mode*, publiſhed at Paris in 4to, 1711. This work is extremely curious, but of no advantage to the ſtudy of muſic. 2. A volume in quarto, printed at Paris 1733, in four parts, intitled, *Bibliotheque des enfans*. In this treatiſe he has placed, in a clear point of view, the ſyſtem and economy of his Typographical Bureau. This invention, like every thing new, was cenſured by ſome and admired by others. The author himſelf defended it with much ſucceſs in the journals and ſeveral occaſional pamphlets. This collection, however, is become exceedingly ſcarce. The Typographical Bureau was brought to perfection by M. Reybert a citizen of Avignon, who enriched it with many articles containing uſeful and agreeable information in geography, hiſtory, fable, &c. &c. 3. *Memoires de l'Ecoſſe ſous le regne de Marie Stuart*, by Crawford, and tranſlated from the Engliſh. This tranſlation was found in manuſcript in the library of the late marquis d'Aubais, with whom Du Mas had lived in the moſt intimate habits of friendſhip.

Mas Planta, a plant which upon the ſame root produces male flowers only. See *Masculus Flos*.

MASAFUERO, an iſland of the South-Sea, lying in S. Lat. 33. 45. W. Long. 80. 46. It is very high and mountainous, and at a diſtance ſeems to conſiſt of one hill or rock. It is of a triangular form, and ſeven or eight leagues in circumference. There is ſuch plenty of fiſh, that a boat with a few hooks and lines may very ſoon catch as many as will ſerve one hundred people. Here are coal-fiſh, cavilliers, cod, hallibut, and cray fiſh. Captain Carteret's crew caught a king-fiſher that weighed 87 pounds, and was five feet and an half long. The ſharks were here ſo ravenous, that in taking ſoundings, one of them ſwallowed the lead, by which they hauled him above water; but he regained his liberty by diſgorging his prey. Seals are ſo numerous here, that Captain Carteret ſays, if many thouſands were killed in a night, they would not be miſſed next morning. Theſe animals yield excellent train-oil; and their hearts and plucks are very good food, having a taſte ſomething like thoſe of a hog; their ſkins are covered with a very fine fur. There are many birds here, and ſome very large hawks. Of the pintado bird one ſhip caught 700 in one night. Commodore Byron landed here with difficulty in 1765, in order to take in wood and water, of both which he found plenty. He found alſo great numbers of goats whoſe fleſh taſted as well as veniſon in England.

MASBOTHÆI, or Mesbothæi, the name of a ſect, or rather of two ſects; for Euſebius, or rather Hegeſippus whom he cites, makes mention of two different ſects of Maſbothæans. The firſt was one of the ſeven ſects that aroſe out of Judaiſm, and proved very troubleſome to the church; the other was one of the ſeven Jewiſh ſects before the coming of Jeſus Chriſt.

The word is derived from the Hebrew שבת *ſchabat*, "to reſt or repoſe," and ſignifies *idle eaſy indolent people*. Euſebius ſpeaks of them as if they had been ſo called from one Maſbotheus their chief: but it is much more probable their name is Hebrew, or at leaſt Chaldaic, ſignifying the ſame thing with a Sabbatarian in our language; that is, one who makes a profeſſion of keeping Sabbath.

Valeſius will not allow the two ſects to be confounded together: the laſt being a ſect of Jews before, or at leaſt contemporary with Chriſt; and the former a ſect of heretics deſcended from them. Rufinus diſtinguiſhes them in their names: the Jewiſh ſect he calls Maſbuthæi; and the heretics Maſbuthæani. The Maſbuthæans were a branch of the Simonians.

MASCARDI (Auguſtin), a diſtinguiſhed perſon in the republic of letters, was born at Sarzane, a city of the ſtate of Genoa, in 1591. He ſpent the early part of his life among the Jeſuits, and afterwards became chamberlain to Pope Urban VIII. He was naturally ſo eloquent, that this ſame pope, merely to exerciſe his talent, founded a profeſſorſhip of rhetoric for him in the college de la Sapienza 1628, and ſettled upon him for life a penſion of 500 crowns. Maſcardi filled the chair with great reputation; but his love of letters made him neglect what is of more conſequence than even letters, the management of his affairs: for he was always poor, and always in debt. He wrote a great many things in verſe and proſe; and among the reſt, a treatiſe entitled *Dell' arte hiſtorica*. In his "Hiſtory of the Conſpiracy of the Comtede Fieſque," he has very frequently attacked the religion of Hubert Folietta; and in his other books he uſed ſome writers in the ſame way, which occaſioned him to be attacked in his turn. The objections which were made to him, together with his anſwers, were added to the ſecond edition of the hiſtory juſt mentioned. He died at Sarazane, 1640, in his 49th year.

MASCARON (Julius), biſhop of Agen, and a moſt eminent French preacher, was born at Marſeilles in 1634. He inherited of his father, who was the moſt celebrated advocate of the parliament of Aix, that uncommon talent of eloquence which diſtinguiſhed him. He was admitted a member of the congregation of the oratory very young: and from his 22d year taught rhetoric at Mans. Soon after this he commenced preacher, and preached with great ſucceſs in St Peter's church at Saumur. The biſhop of Mans, willing to engage ſo able a preacher in his church, made him prebendary of it. He was much admired at Paris, when he preached the advent at the oratory. He preached after this five or ſix years at court, and was promoted to the biſhopric of Tulle in 1671. He was afterwards tranſlated to the biſhoric of Agen. He was called in 1694 to preach the Lent ſermon at court. The year following, he opened the aſſembly of the clergy, and returned to his dioceſe; where he died of a dropſy in his cheſt, Dec. 16. 1703. There is nothing printed of this great man excepting A Collection of Funeral Orations made upon the queen-mother, the dauphineſs, the duke of Beaufort, the chancellor Seguier, mareſchal Turenne; and at the head of this collection there is a ſhort life of him.

MASCLEF (Francis), was at firſt a curate in the dioceſe of Amiens, the place of his birth, and afterwards theologian and confidant to the virtuous De Brou biſhop of that dioceſe. He was appointed to the charge of a ſeminary of learning under that prelate. He deſerved this employment both from his piety and profound learning. The oriental languages were as familiar to him as his native tongue. He purſued his reſearches into the idioms of the eaſt with the ſpirit and the ingenuity of a philoſopher. He was made canon of Amiens a little before the death of De Brou, which happened in 1706. His opinions on the Janſeniſt controverſy were ſo offenſive to Sabbatier, the ſucceſſor of that worthy prelate, that he was removed from the care of the ſeminary and from almoſt every other public office which he held. The regard of the dead comforted Maſclef under the oppreſſion of the living. He devoted himſelf to ſtudy with ſo much ardour, that he contracted a diſeaſe of which he died the 14th Nov. 1728, aged 66 years. His principal works are, 1. A Hebrew Grammar in Latin, after his new method, printed at Paris 1716, in 12mo. This grammar was again printed in two volumes in 12mo in the year 1730, under the direction of M. de la Bletterie at that time prieſt of the oratory and the friend of Maſclef. All the objections which Father Guarin made in his Hebrew grammar to Maſclef's method of reading Hebrew without the uſe of points are attended to in this edition. There is nothing more neceſſary, according to this plan, than to take the vowel which is next the conſonant in the order of the alphabet. This method was approved of by ſome learned men, but rejected by a great many more. 2. *Les Conferences Eccleſiaſtiques du dioceſe d'Amiens*, in 12mo. 3. *Le Catechiſme d'Amiens*, in 4to, 4. *Une Philoſophie et une Theologie*, in MS. Theſe would have been publiſhed had they not diſcovered a partiality to the principles of Janſeniſm. The author was an auſtere man, equally reſpectable for his manners and his knowledge.

MASCULINE, ſomething belonging to the male, or the ſtronger of the two ſexes. See MALE.

MASCULINE, is more ordinarily uſed in grammar to ſignify the firſt and worthieſt of the genders of nouns. See GENDER.

The maſculine gender is that which belongs to the male kind, or ſomething analogous to it.

Moſt ſubſtances are ranged under the heads of maſculine or feminine.—This, in ſome caſes, is done with a ſhow of reaſon; but in others is merely arbitrary, and for that reaſon is found to vary according to the languages and even according to the words introduced from one language into another.—Thus the names of trees are generally feminine in Latin and maſculine in the French.

Farther, the genders of the ſame word are ſometimes varied in the ſame language. Thus *alvus*, according to Priſcian, was anciently maſculine, but is now become feminine. And *navire*, "a ſhip," in French, was anciently feminine, but is now maſculine.

MASCULINE Rhyme, in the French poetry, is that made with a word which has a ſtrong, open, and accented pronunciation; as all words have, excepting thoſe which have an *e* feminine in their laſt ſyllable. For inſtance, *amour* and *jour*, *mort* and *ſort*, are maſculine rhymes; and *pere* and *mere*, *gloire* and *memoire*, are feminine. Hence alſo verſes ending with a maſculine rhyme, are called *maſculine verſes*, and thoſe ending with a feminine rhyme, *feminine verſes*. It is now a rule eſtabliſhed among the French poets never to uſe the above two maſculine or two feminine verſes ſucceſſively, except in the looſer kind of poetry. Marot was the firſt who introduced this mixture of maſculine and feminine verſes, and Ronſard was the firſt who practiſed it with ſucceſs. The maſculine verſes ſhould always have a ſyllable leſs than the feminine ones.

MASCULINE Signs. Aſtrologers divide the ſigns into maſculine and feminine; by reaſon of their qualities, which are either active, and hot or cold, accounted maſculine; or paſſive, dry and moiſt, which are feminine. On this principle they call the Sun, Jupiter, Saturn, and Mars, *maſculine*; and the Moon and Venus *feminine*. Mercury, they ſuppoſe, partakes of the two. Among the ſigns, Aries, Libra, Gemini, Leo, Sagittarius, Aquaris, are maſculine: Cancer, Capricornus, Taurus, Virgo, Scorpio, and Piſces, are feminine.

MASCULUS FLOS, in botany. See FLOS.

MASH, a drink given to a horſe, made of half a peck of ground malt put into a pail, into which as much ſcalding hot water is poured as will wet it very well: when that is done, ſtir it about, till, by taſting, you find it as ſweet as honey; and when it has ſtood till it is lukewarm, it is to be given to the horſe. This liquor is only uſed after a purge, to make it work the better; or after hard labour, or inſtead of drink in the time of any great ſickneſs.

MASK. See MASQUE.

MASINISSA, a king of a ſmall part of Africa, who at firſt aſſiſted the Carthaginians in their wars againſt Rome; but afterwards joined the Romans, and became the firmeſt ally they ever had. See NUMIDIA.

MASON, a perſon employed under the direction of an architect, in the raiſing of a ſtone-building.

The chief buſineſs of a maſon is to make the mortar; raiſe the walls from the foundation to the top, with the neceſſary retreats and perpendiculars; to form the vaults, and employ the ſtones as delivered to him. When the ſtones are large, the buſineſs of hewing or cutting them belongs to the ſtone-cutters, though theſe are frequently confounded with maſons: the ornaments of ſculpture are performed by carvers in ſtones or ſculptors. The tools or implements principally uſed by them are the ſquare, level, plumb-line, bevel, compaſs, hammer, chiſſel, mallet, ſaw, trowel, &c. See Square, &c.

Beſides the common inſtruments uſed in the hand, they have likewiſe machines for raiſing of great burdens, and the conducting of large ſtones; the principal of which are the lever, pulley, wheel, crane, &c. See Lever, &c.

Free and Accepted Masons, a very ancient ſociety or body of men: ſo called, either from ſome extraordinary knowledge of maſonry or building, which they are ſuppoſed to be maſters of, or becauſe the firſt founders of the ſociety were perſons of that profeſſion. Theſe are now very conſiderable, both for number and character, being found in every country in Europe, and conſiſting principally of perſons of merit and conſideration. As to antiquity, they lay claim to a ſtanding of ſome thouſand years. What the end of their inſtitution is, ſeems ſtill in ſome meaſure a ſecret: and they are ſaid to be admitted into the fraternity by being put in poſſeſſion of a great number of ſecrets, called the *maſon's word*, which have been religiouſly kept from age to age, being never divulged. See *Free-Masonry*.

MASONRY, in general, a branch of architecture, conſiſting in the art of hewing or ſquaring ſtones, and cutting them level or perpendicular, for the uſes of building: but, in a more limited ſenſe, maſonry is the art of aſſembling and joining ſtones together with mortar.

Hence ariſe as many different kinds of maſonry as there are different forms and manners for laying or joining ſtones. Vitruvius mentions ſeveral kinds of maſonry uſed among the ancients; three of hewed ſtone, *viz.* that in form of a net, that in binding, and that called the *Greek maſonry*; and three of unhewed ſtones, *viz.* that of an equal courſe, that of an unequal courſe, and that filled up in the middle; and the ſeventh was a compoſition of all the reſt.

Net-maſonry, called by Vitruvius *reticulatum*, from its reſemblance to the meſhes of a net, conſiſts of ſtones ſquared in their courſes, and ſo diſpoſed as that their joints go obliquely; and their diagonals are the one perpendicular and the other level. This is the moſt agreeable maſonry to the eye, but it is very apt to crack. See nº 1.

Bound-maſonry, that in which the ſtones were placed one over another, like tiles; the joints of their beds being level, and the mounters perpendiculars, ſo that the joint that mounts and ſeparates two ſtones always falls directly over the middle of the ſtone below. This is leſs beautiful than the net-work; but it is more ſolid and durable. See nº 2.

Greek maſonry, according to Vitruvius, is that where after we have laid two ſtones, each of which makes a courſe, another is laid at the end, which makes two courſes, and the ſame order is obſerved throughout the building; this may be called *double-binding*, in regard the binding is not only of ſtones of the ſame courſe with one another, but likewiſe of one courſe with another courſe. See nº 3.

Maſonry by equal courſes, called by the ancients *iſodomum*, differs in nothing from the bound maſonry, but only in this, that its ſtones are not hewn. See nº 4.

Maſonry by unequal courſes, called *pſeudiſodomum*, is alſo made of unhewed ſtones, and laid in bound work; but then they are not of the ſame thickneſs, nor is there any equality obſerved excepting in the ſeveral courſes, the courſes themſelves being unequal to each other. See nº 5.

Maſonry filled up in the middle, is likewiſe made of unhewed ſtones, and by courſes; but the ſtones are only ſet in order as to the courſes: (ſee nº 6). A, the courſes; B, the parts filled up; C, a coat of plaſter.

Compound maſonry is of Vitruvius's propoſing, ſo called as being formed of all the reſt. In this the courſes are of hewed ſtone; and the middle being left void, is filled up with mortar and pebbles thrown in together: after this the ſtones of one courſe are bound to thoſe of another courſe with iron-cramps faſtened with melted lead: (See nº 7). E, the ſtones cramped; F, the cramps; G, the middle part filled up.—Nº 8. repreſents another ſort of compound maſonry, the middle of which is ſtone, and the edges boards.

All the kinds of maſonry now in uſe may be reduced to theſe five, *viz.* bound maſonry; that of brick-work, where the bodies and projectures of the ſtones incloſe ſquare ſpaces or pannels, &c. ſet with bricks; that de moilon, or ſmall work, where the courſes are equal, well ſquared, and their edges or beds ruſticated; that where the courſes are unequal; and that filled up in the middle with little ſtones and mortar.

Free-Masonry, denotes the ſyſtem of myſteries and ſecrets peculiar to the ſociety of free and accepted maſons.

The origin of this ſociety is very ancient; but we have no authentic account of the time when it was firſt inſtituted, or even what was the reaſon of ſuch an aſſociation of people under the title of *Maſons*, more than of any other mechanical profeſſion.—In Dr Henry's hiſtory we find the origin of the Free Maſon Society in Britain attributed to the difficulty found in former times, of procuring a ſufficient number of workmen to build the multitude of churches, monaſteries, and other religious edifices which the ſuperſtition of thoſe ages prompted the people to raiſe. Hence the maſons were greatly favoured by the popes, and many indulgences were granted in order to augment their numbers. In times like thoſe we ſpeak of, it may well be ſuppoſed that ſuch encouragement from the ſupreme paſtors of the church muſt have been productive of the moſt beneficial effects to the fraternity; and hence the increaſe of the ſociety may naturally be deduced. The Doctor quotes, in confirmation of this, the words of an author who was well acquainted with their hiſtory and conſtitution. “The Italians (ſays he), with ſome Greek refugees, and with them French, Germans, and Flemings, joined ed into a fraternity of architects, procuring papal bulls for their encouragement and their particular privilages; they ſtyled themſelves *Free-maſons*, and ranged from one nation to another, as they found churches to be built: their government was regular: and where they fixed near the building in hand, they made a camp of huts. A ſurveyor governed in chief, every tenth man was called a *warden*, and overlooked each nine. The gentlemen in the neighbourhood, either out of charity or commutation of penance, gave the materials and carriages. Thoſe who have ſeen the accounts in records of the charge of the fabrics of ſome cathedrals near 400 years old, cannot but have a great eſteem for their economy, and admire how ſoon they erected ſuch lofty ſtructures."

By other accounts, however, the antiquity of maſonry is carried up much higher, even as early as the building of Solomon's temple. In Britain the introduction of maſonry has been fixed at the year 674, when glaſs-making was firſt introduced; and it appears indeed, that from this time many buildings in the Gothic ſtyle were erected by men in companies, who are ſaid to have called themſelves *free*, becauſe they were at liberty to work in any part of the kingdom. Others have derived the inſtitution of free maſons from a combination among the people of that profeſſion not to work without an advance of wages, when they were ſummoned from ſeveral counties, by writs of Edward III. directed to the ſheriffs, to aſſiſt in rebuilding and enlarging the caſtle, together with the church and chapel of St George at Windſor, At this time, it is ſaid, the maſons agreed on certain tokens by which they might know and aſſiſt each other againſt being impreſſed, and not to work unleſs free and on their own terms.

In a treatiſe on Maſonry publiſhed in 1792 by William Preſton, maſter of the Lodge of Antiquity, the origin of maſonry is traced from the creation. "Ever ſince ſymmetry began, and harmony diſplayed her charms (ſays he), our order has had a being." Its introduction into England he likewiſe ſuppoſes to have been prior to the Roman invaſion. There are, according to him, the remains yet exiſting of ſome ſtupendous works executed by the Britons much earlier than the time of the Romans; and even theſe diſplay no ſmall ſhare of ingenuity of invention: ſo that we can have no doubt of the exiſtence of maſonry in Britain even during theſe early periods. The Druids are likewiſe ſaid to have had among them many cuſtoms ſimilar to thoſe of the maſons, and to have derived their government from Pythagoras; but the reſemblance betwixt their uſages and thoſe of the free-maſon ſocieties now exiſting cannot be accurately traced even by the maſons themſelves.

Maſonry is ſaid to have been encouraged by Cæſar, and many of the Roman generals who were appointed governors of Britain: but though we know, that at this period the fraternity were employed in erecting many magnificent fabrics, nothing is recorded concerning their lodges and conventions; and we have but a very imperfect account of the cuſtoms which prevailed in their aſſemblies.

For a long time the progreſs of maſonry in Britain was obſtructed by the frequent wars which took place; and it did not revive till the time of Carauſius, by whom it was patroniſed. This general, who hoped to be the founder of a Britiſh empire, encouraged learning and learned men: collecting alſo the beſt artificers from many different countries, particularly maſons, whom he held in great veneration, and appointing Albanus his ſteward the principal ſuperintendant of their aſſemblies. Lodges, or conventions of the fraternity, began now to be introduced, and the buſineſs of maſonry to be regularly carried on. The maſons, through the influence of Albanus, obtained a charter from Carauſius to hold a general council, at which Albanus himſelf ſat preſident, and aſſiſted at the reception of many new members. This Albanus was the celebrated Alban, the firſt who ſuffered martyrdom in Britain for the Chriſtian faith. Mr Preſton quotes an old MS. deſtroyed with many others, ſaid to have been in the poſſeſſion of Nicholas Stone, a curious ſculptor under Inigo Jones; from which we learn that St Alban was a great friend to maſons, and gave them two ſhillings per week beſides threepence for their chear: while, before that time, they had no more than one penny per day and their meat. He likewiſe obtained "a charter from the king and his council for them to hold a general council, which was named an *aſſembly*." The ſame circumſtances are mentioned in a MS. written in the time of James II. only this increaſes the weekly ſalary of the maſons to 3s. 6d. and 3d. per day for the bearers of burthens.

The progreſs of maſonry was greatly obſtructed by the departure of the Romans from Britain; and in a ſhort time fell into abſolute neglect. This was occaſioned firſt by the furious irruptions of the Scots and Picts, which left no time for the cultivation of the arts; and afterwards by the ignorance of the Saxons, whom the ill-adviſed Britains called in as allies, but who ſoon became their maſters. After the introduction of Chriſtianity, however, the barbarity of theſe conquerors began to wear off, the arts received ſome encouragement, and maſonry particularly began to flouriſh. Lodges were now formed; but theſe being under the direction of foreigners, were ſeldom convened, and never attained to any degree of conſideration or importance. In this ſituation it continued till the year 557, when St Auſtin, with 40 monks, among whom the ſciences had been preſerved, came into England. By theſe the principles of Chriſtianity were propagated with ſuch zeal, that all the kings of the heptarchy were converted; after which maſonry was taken under the patronage of St Auſtin and the Gothic ſtyle of building was introduced into England by the numerous foreigners who reſorted at this time to the kingdom. Auſtin himſelf appeared at the head of the fraternity in founding the old cathedral of Canterbury in 600: that of Rocheſter in 602: St Paul's in London in 604: St Peter's in Weſtminſter in 605, as well as many others. The number of maſons in England was thus greatly increaſed, as well as by his other buildings of caſtles, &c. throughout the kingdom.

In 640 a few expert brethren arrived from France, and formed themſelves into a lodge under the direction of Bennet abbot of Wirral; whom Kenred king of Mercia ſoon after appointed inſpector of the lodges, and general ſuperintendant of the maſons. During the whole time of the heptarchy, however, maſonry was in a low ſtate, but began to revive in 856 under the patronage of St Swithin, whom Ethelwolf employed to repair ſome religious houſes: and from that time the art gradually improved till the year 872, when it found a zealous protector in Alfred the Great. This prince was a moſt eminent patron of all kinds of arts and manufactures: and, with regard to maſonry in particular, he appropriated a ſeventh part of his revenue for maintaining a number of workmen, whom he conſtantly employed in rebuilding the cities, caſtles, &c. ruined by the Danes. During the reign of his ſucceſſor Edward, the maſons continued to hold their lodges under the ſanction of Ethred, huſband to the king's ſiſter, and Ethelward his brother, to whom the care of the fraternity was intruſted. The latter was a great architect, and founded the univerſity of Cambridge.

The true re-eſtabliſhment of maſonry in England, however, is dated from the reign of King Athelſtane; and there is ſtill extant, a grand lodge of maſons at York, who trace their exiſtence from this period. This lodge, the moſt ancient in England, was founded in 626, under the patronage of Edwin the king's brother, who obtained for them a charter from Athelſtane, and became grand maſter himſelf. By virtue of this charter it is ſaid, that all the maſons in the kingdom were convened at a general aſſembly in that city, where they eſtabliſhed a general or grand lodge for their future government. Under the patronage and juriſdiction of this lodge it is alſo alleged that the fraternity increaſed very conſiderably, and that kings, and princes, and other eminent perſons who had been initiated into the myſteries, paid due allegiance to the aſſembly. But as the times were yet turbulent and barbarous, the art of maſonry was ſometimes more ſometimes leſs patroniſed; and of courſe the aſſembly more or leſs reſpected according to the reſpect which the art itſelf met with. The appellation of *ancient-York maſons* is well known both in Ireland and Scotland, and the general tradition is, that they originated at Auldby near York; and as Auldby was a ſeat of Edwin, this tradition gives conſiderable confirmation to the above account. There is indeed great reaſon to believe that York was the original ſeat of maſonic governmen', no other place having claimed it, and the whole fraternity having at various times owned allegiance to the authority there eſtabliſhed; though we know not whether that allegiance be now given or not. Certain it is, that if ſuch a lodge was once eſtabliſhed there, of which there is no reaſon to doubt, we have no account of its being regularly moved from that place to any other part of the kingdom, with conſent of its members. Many reſpectable meetings have indeed been held at different times in other parts of the kingdom, but there is no account of any other general meeting being held in another place than York till very lately.

While prince Edwin lived, the maſons were employed as formerly in building churches, monaſteries, &c. and repairing thoſe which had ſuffered by the ravages of the Danes; and after his death the order was patroniſed by king Athelſtane himſelf; but on his deceaſe the maſons were diſperſed, and remained in an unſettled ſtate till the reign of Edgar in 690. They were now collected by St Dunſtan, who employed them in works of the ſame kind: but as no permanent encouragement was given them, their lodges ſoon declined, and maſonry remained in a low ſtate for upwards of 50 years. It revived, however, in 1041, under Edward the Confeſſor, who ſuperintended the execution of ſeveral great works. By the aſſiſtance of Leofric earl of Coventry, he rebuilt Weſtminſter Abbey, the earl being appointed ſuperintendant of the maſons; and by this architect many other magnificent ſtructures were likewiſe erected. After the conqueſt, in 1066, Gundulph biſhop of Rocheſter and Roger de Montgomery earl of Shrewſbury, both of them excellent architects, became joint patrons of the maſons; and under their auſpices the Tower of London was begun, though finiſhed only in the reign of William Rufus, who likewiſe rebuilt London Bridge with wood, and in 1087 firſt conſtructed the palace and hall of Weſtminſter,

The maſons now continued to be patroniſed by the ſovereigns of England in ſucceſſion. The lodges aſſembled during the reign of Henry I. and during that of Stephen, the ſociety were employed in building a chapel at Weſtminſter, now the Houſe of Commons, and ſeveral other works; the preſident of the lodges being under Gilbert de Clare, the marquis of Pembroke. During the reign of Henry II. the lodges were ſuperintended by the grand-maſter of the Knights Templars, who employed them in building their temple in Fleet-ſtreet in the year 1155. Maſonry continued under the patronage of this order till the year 1199, when John ſucceeded Richard I. in the throne of England, and Peter de Colechurch was then appointed grand-maſter. He began to rebuild London-bridge with ſtone, which was afterwards finiſhed by William Alcmain in 1209. Peter de Rupibus ſucceeded Peter de Colechurch in the office of grand-maſter, and Geoffrey Fitz-Peter, chief ſurveyor of the king's works, acted as deputy under him: maſonry continued alſo to flouriſh under the auſpices of theſe two artiſts during this and the following reign. On the acceſſion of Edward I. in 1272, the ſuperintendance of the maſons was entruſted to Walter Giffard archbiſhop of York. Gilbert de Clare earl of Glouceſter, and Ralph lord of Mount Hermer, the progenitor of the family of the Montagues; and by theſe architects the abbey of Weſtminſter was finiſhed, after having been begun in 1220, during the minority of Henry II. During the reign of Edward II. the fraternity were employed in building Exeter and Oriel Colleges in Oxford, Clare-hall in Cambridge, &c. under the auſpices of Walter Stapleton biſhop of Exeter, who had been appointed grand-maſter of the maſons in 1307.

Edward III. was a great encourager of learning in general, and not only patroniſed the maſons, but applied very aſſiduouſly to the conſtitutions of the order, reviſed and meliorated the ancient charges, and added ſeveral uſeful regulations to the original code by which the fraternity had been governed. He patroniſed the lodges, and appointed five deputies under him to inſpect their proceedings; and at this period it appears from ſome old records, that the lodges were numerous, and that the fraternity held communications under the protection of the civil magiſtrates. William a Wykeham was continued grand-maſter on the acceſſion of

Richard

Richard II. and by him both the New College in Oxford and Wincheſter College were founded at his own expence. After the acceſſion of Henry IV. Thomas Fitz-Allan earl of Surrey was appointed grand-maſter, who after the engagement at Shrewſbury, founded Battle-abbey and Fotheringay; the Guildhall at London being alſo built in this reign. On the acceſſion of Henry V. the fraternity were directed by Henry Chichely archbiſhop of Canterbury, under whom the lodges and communications of the fraternity were frequent. In 1425, however, during the reign of Henry VI. an act was made againſt the meetings of the chapters and congregations of maſons, becauſe it was ſaid, that by ſuch meetings "the good courſe and effect of the ſtatutes of labourers were openly violated and broken, in ſubverſion of the law, and to the great damage of all the commons." But this act was not put in force, nor did the fraternity ceaſe to meet as uſual under the protection of archbiſhop Chichely, who ſtill continued to preſide over them. The reaſon of this extraordinary edict is ſaid to have been as follows. The duke of Bedford, at that time regent of the kingdom, being in France, the regal power was veſted in his brother Humphrey duke of Glouceſter, who was ſtyled protector and guardian of the kingdom. The care of the young king's perſon and education was entruſted to Henry Beaufort biſhop of Wincheſter, the duke's uncle. This prelate being of an ambitious diſpoſition, and aſpiring at the ſole government, had continual diſputes with his nephew the protector; and by reaſon of the violent temper of that prince, gained frequent advantages over him. This animoſity increaſed to ſuch a degree that the parliament was at length obliged to interpoſe. On the meeting of that aſſembly in the month of April 1425, however, the ſervants and followers of the peers came thither, armed with clubs and ſtaves; on which account it received the name of the *Bat Parliament*, and at this time the act againſt maſons was made. This was owing to the influence of the biſhop, who wiſhed to deſtroy the meetings of the fraternity on account of the ſecrecy obſerved in them. Dr Anderſon, in the firſt edition of the Book of Conſtitutions, makes the following obſervation upon this act: "It was made in ignorant times, when true learning was a crime, and geometry condemned for conjuration; but it cannot derogate from the honour of the ancient fraternity, who, to be ſure, would never encourage any ſuch confederacy of their working brethren. By tradition, it is believed that the parliament were then too much influenced by the illiterate clergy, who were not accepted maſons, nor underſtood architecture (as the clergy of ſome former ages,) and were generally thought unworthy of this brotherhood. Thinking they had an indefeaſible right to know all ſecrets by virtue of auricular confeſſion, and the maſons never confeſſing any thing thereof, the ſaid clergy were highly offended; and at firſt, ſuſpecting them of wickedneſs, repreſented them, as dangerous to the ſtate during that minority; and ſoon influenced the parliament to lay hold of ſuch ſuppoſed arguments of the working maſons for making an act that might ſeem to reflect diſhonour upon even the whole fraternity, in whoſe favor ſeveral acts had been made before that period, and were made after it."

The biſhop was ſoon after this diverted from his perſecution of the maſons by an affair of a more important kind. He had formed a deſign of ſurpriſing the city of London on the evening of St Simon and St Jude's day, that on which the Lord Mayor was inveſted with his office. But the plot having been diſcovered by the duke of Glouceſter, the Mayor was ſent for while at dinner, and ordered to keep a ſtrict watch for that night. The biſhop's party accordingly made an attempt to enter by the bridge about nine the next morning, but were repulſed by the vigilance of the citizens. At this the prelate was ſo much enraged, that he collected a numerous body of archers and men at arms, commanding them to aſſault the gate with ſhot. By the prudence of the magiſtrates, however, all violent meaſures were ſtopped; but no reconciliation could be procured betwixt the two parties, though it was attempted by the archbiſhop of Canterbury, and Peter duke of Coimbra, eldeſt ſon to the king of Portugal, with ſeveral other perſons of diſtinction. At laſt the biſhop wrote a letter to the duke of Bedford, urging his return to England, and informing him of the danger there was of a civil war, and reflecting upon the duke of Gouceſter. This letter had the deſired effect. The regent returned, and held a great council at St Albans on the 21ſt of February, but adjourned it to the 15th of March at Northampton, and to the 25th of June at Leiceſter. Bats and ſtaves were now prohibited at theſe meetings; but the parties aſſembled with weapons no leſs formidable, viz. with ſlings, ſtones, and leaden plummets. The duke of Bedford employed all his authority to reconcile the differences; and at laſt obliged the two rivals to promiſe before the aſſembly that they would bury all animoſities in oblivion. During the diſcuſſion of this matter five charges were exhibited by the duke of Glouceſter againſt the biſhop; one of which was, that "he had, in his letter to the duke of Bedford, at France, plainly declared his malicious purpoſe of aſſembling the people, and ſtirring up a rebellion in the nation, contrary to the king's peace." To this the biſhop anſwered, "That he never had any intention to diſturb the peace of the nation or raiſe a rebellion; but that he ſent to the duke of Bedford to ſolicit his return to England, to ſettle all thoſe differences which were ſo prejudicial to the peace of the kingdom: That though he had indeed written in the letter, 'That if he tarried, we ſhould put the land in adventure by a field, ſuch a brother you have here,' he did not mean it of any deſign of his own, but concerning the ſeditious aſſemblies of maſons, carpenters, tylers, and plaiſterers; who being diſtreſſed by the late act of parliament againſt the exceſſive wages of theſe trades, had given out many ſeditious ſpeeches and menaces againſt certain great men, which tended much to rebellion." &c.

Notwithſtanding this heavy charge, the duke of Glouceſter, who knew the innocence of the parties accuſed, took the maſons under his protection, and transferred the charge of ſedition and rebellion from them to the biſhop and his followers. By the intereſt of the latter, however, the king ganted him a pardon for all offences; and though the duke drew up freſh articles of impeachment againſt him in 1442, and preſented them in perſon to the king, the council, being compoſed moſtly of eccleſiaſtics, proceeded ſo ſlowly in the buſineſs, that the duke, wearied out with the tediousneſs of the matter, dropped the proſecution entirely.

This conteſt terminated in the impeachment, impriſonment, and murder of the duke of Glouceſter himſelf. This event might have been attended with bad conſequence, had not their inveterate enemy, the prelate himſelf, been taken off by death in about two months after the duke. The maſons then continued not only to meet in ſafety, but were joined by the king himſelf. He was, that very year (1442) initiated into maſonry, and from that time ſpared no pains to become completely maſter of the art. He peruſed the ancient charges, reviſed the conſtitutions, and, with the conſent of his council, honoured them with his ſanction. The example of the ſovereign was followed by many of the nobility, who aſſiduouſly ſtudied the art. The king preſided over the lodges in perſon, nominating William Wanefleet biſhop of Wincheſter grand-maſter. This biſhop at his own expence built Magdalene college, Oxford, and ſeveral religious houſes. Eton-college near Windſor, and King's-college at Cambridge, were alſo founded during this reign. Henry himſelf founded Chriſt's-college, Cambridge, as his queen Margaret of Anjou did Queen's-college in the ſame univerſity.

About this time alſo, the maſons were protected and encouraged by James I. of Scotland, who, after his return from captivity, became a zealous patron of arts and learning of all kinds. He honoured the lodges with his royal preſence, and ſettled an annual revenue of four pounds Scots (an Engliſh noble) to be paid by every maſter-maſon in Scotland, to a grand-maſter choſen by the grand lodge, and approved by the crown, one nobly born, or an eminent clergyman who had his deputies in cities and counties: ſomething was likewiſe paid him by every new brother at his entry. His office intitled him to regulate every thing in the fraternity which could not come under the juriſdiction of law-courts; and, to prevent law-ſuits, both maſon and lord, or builder and founder, appealed to him. In his abſence, they appealed to his deputy or grand-warden, who reſided next the premiſes.

The flouriſhing ſtate of maſonry was interrupted by the civil wars between the houſes of York and Lancaſter, which brought it almoſt totally into neglect. About 1471, however, it revived under the auſpices of Robert Beauchamp biſhop of Sarum, who had been appointed grand-maſter by Edward IV. and honoured with the title of *Chancellor of the Garter*, for repairing the caſtle and chapel of Windſor. It again declined during the reigns of Edward V. and Richard III.; but came once more into repute on acceſſion of Henry VIII. in 1485. It was now patroniſed by the maſter and fellows of the order of St John at Rhodes (now Malta); who aſſembled their grand-lodge in 1500, and choſe Henry for their protector. On the 24th of June 1502, a lodge of maſters was formed in the palace, at which the king preſided as grand-maſter; and having appointed John Iſlip abbot of Weſtminſter, and Sir Reginald Bray knight of the garter, his wardens for the occaſion, proceeded in great ſtate to the eaſt end of Weſtminſter abbey, where he laid the firſt ſtone of that excellent piece of Gothic architecture called *Henry the Sevenths Chapel*. The cape-ſtone of this building was celebrated in 1507. The palace of Richmond, as well as many other noble ſtructures, were raiſed under the direction of Sir Reginald Bray; and the colleges of Brazen-Noſe in Oxford, and Jeſus and St John's in Cambridge, were all finiſhed in this reign.

On the acceſſion of Henry VIII. Cardinal Wolſey was appointed grand-maſter; who built Hampton-court, Whitehall, Chriſt-church college, Oxford, with ſeveral other noble edifices; all of which, upon the diſgrace of that prelate, were forfeited to the crown in 1530. Wolſey was ſucceeded as grand-maſter in 1534 by Thomas Cromwell earl of Eſſex; who employed the fraternity in building St James's palace, Chriſt's hoſpital, and Greenwich caſtle. Cromwell being beheaded in 1540, John Touchet lord Audley ſucceeded to the office of grand-maſter, and built Magdalen college in Cambridge, and many other ſtructures. In 1547, the duke of Somerſet, guardian to the king, and regent of the kingdom, became ſuperintendant of the maſons, and built Somerſet-houſe in the Strand; which, on his being beheaded, was forfeited to the crown in 1552.

After the death of the duke of Somerſet, John Poynet biſhop of Wincheſter preſided over the lodges till the death of the king in 1553. From this time they continued without any patron till the reign of Elizabeth, when Sir Thomas Sackville accepted of the office of grand-maſter. Lodges, however, had been held during this period in different parts of England; but the general or grand lodge aſſembled in the city of York, where it is ſaid the fraternity were numerous and reſpectable.—Of the queen we have the following curious anecdote with regard to the maſons: Hearing that they were in poſſeſſion of many ſecrets which they refuſed to diſcloſe, and being naturally jealous of all ſecret aſſemblies, ſhe ſent an armed force to York to break up their annual grand-lodge. The deſign was prevented by the interpoſition of Sir Thomas Sackville, who took care to initiate ſome of the chief officers wham ſhe had ſent on this duty in the ſecrets of maſonry. Theſe joined in communication with their new brethren, and made ſo favourable a report to the queen on their return, that ſhe countermanded her orders, and never afterwards attempted to diſturb the meetings of the fraternity. In 1567, Sir Thomas Sackville reſigned the office of grand-maſter in favour of Francis Ruſſel earl of Bedford, and Sir Thomas Greſham an eminent merchant. The former had the care of the brethren in the northern part of the kingdom aſſigned to him, while the latter was appointed to ſuperintend the meetings in the ſouth, where the ſociety had conſiderably increaſed, in conſequence of the honourable report which had been made to the queen. The general aſſembly, however, continued to meet at York as formerly; and here all records were kept, and appeals made on every important occaſion to the aſſembly.

Sir Thomas Greſham abovementioned propoſed to erect a building in the city of London for the benefit of commerce, provided the citizens would purchaſe a ſpot proper for the purpoſe. Accordingly ſome houſes

houſes between Cornhill and Threadneedle-ſtreet being pulled down, the foundation-ſtone of the building was laid on the 7th of June 1566, and with ſuch expedition was the work carried on, that the whole was finiſhed in November 1567. This building, which was conſtructed on the plan of the exchange of Antwerp, was called at firſt ſimply *the Bourſe*, but in January 1570, the queen having dined with Sir Thomas, returned through Cornhill, entered the Bourſe on the ſouth ſide, and having viewed every part of the building, particularly the gallery which extended round the whole ſtructure, and which was furniſhed with ſhops filled with all ſorts of the fineſt merchandize in the city, ſhe cauſed the edifice to be proclaimed, in her preſence, by herald and trumpet, the *Royal Exchange;* and on this occaſion, it is ſaid Sir Thomas appeared publicly in the character of grand-maſter.

The queen being now thoroughly convinced that the fraternity of maſons did not interfere in ſtate affairs, became quite reconciled to their aſſemblies, and from this time maſonry made a conſiderable progreſs; lodges were held in different parts of the kingdom, particularly in London and its neighbourhood, where the number of the brethren increaſed conſiderably. Several great works were carried on there under the auſpices of Sir Thomas Greſham, from whom the fraternity received every encouragement.

Sir Thomas was ſucceeded in the office of grand-maſter by Charles Howard earl of Effingham, who continued to preſide over the lodges in the ſouth till the year 1588, when George Haſtings earl of Huntingdon was choſen grand-maſter, and remained in the office till the deceaſe of the queen in 1603.

On the acceſſion of James I. to the crown of England, maſonry flouriſhed in both kingdoms, and lodges were held in both kingdoms, A number of gentlemen returned from their travels, with curious drawings of the old Greek and Roman architecture, as well as ſtrong inclination to revive a knowledge of it. Among theſe was the celebrated Inigo Jones, who was appointed general ſurveyor to the king. He was named grand-maſter of England, and was deputed by the king to preſide over the lodges (A). Several learned men were now initiated into the myſteries of maſonry, and the ſociety increaſed conſiderably in reputation and conſequence. Ingenious artiſts reſorted to England in great numbers; lodges were conſtituted as ſeminaries of inſtruction in the ſciences and polite arts after the model of the Italian ſchools; the communications of the fraternity were eſtabliſhed, and the annual feſtivals regularly obſerved. Under the direction of this accompliſhed architect, many magnificent ſtructures were raiſed; and among the reſt he was employed, by command of the ſovereign, to plan a new palace at Whitehall, worthy of the reſidence of the kings of England. This was executed; but for want of a parliamentary fund, no more of the plan was ever finiſhed than the banqueting-houſe. Inigo Jones continued in the office of grand-maſter till the year 1631, when he was ſucceeded by the earl of Pembroke; under whoſe auſpices many eminent and wealthy men were initiated, and the myſteries of the order held in high eſtimation.

After Charles I. aſcended the throne, Earl Pembroke was continued in his office till the year 1630, when he reſigned in favour of Henry Danvers earl of Danby. This nobleman was ſucceeded in 1633 by Thomas Howard earl of Arundel, the anceſtor of the Norfolk family. In 1635, Francis Ruſſel earl of Bedford accepted the government of the ſociety; but Inigo Jones having continued to patronize the lodges during his lordſhip's adminiſtration, he was re-elected the following year, and continued in office till the year of his death, 1646. The progreſs of maſonry, however, was for ſome time obſtructed by the breaking out of the civil wars; but it began to revive under the patronage of Charles II. who had been received into the order during his exile. Some lodges during this reign were conſtituted by *leave* of the *ſeveral* noble grand-maſters, and many gentlemen and famous ſcholars requeſted at that time to be admitted into the fraternity. On the 27th of December 1663, a general aſſembly was held, where Henry Jennyn earl of St Alban's was elected grand-maſter; who appointed Sir John Denham his deputy, and Mr Criſtopher Wren, afterwards the celebrated Sir Chriſtopher Wren, and John Webb, his wardens. At this aſſembly ſeveral uſeful regulations were made, for the better government of the lodges; and the greateſt harmony prevailed among the whole fraternity. The earl of St Alban's was ſucceeded in his office of grand-maſter by earl Rivers in the year 1666, when Sir Chriſtopher Wren was appointed deputy, and diſtinguiſhed himſelf beyond any of his predeceſſors in promoting the proſperity of the lodges which remained at that time, particularly that of St Paul's, now the lodge of Antiquity, which he patronized upwards of 18 years. At this time he attended the meetings regularly; and during his preſidency made a preſent to the lodge of three mahogany candleſticks, which at that time were very valuable. They are ſtill preſerved, and highly valued as a teſtimony of the eſteem of the donor.

The fire which in 1666 deſtroyed ſuch a great part of London, afforded ample opportunity for the maſons to exert their abilities. After a calamity ſo ſudden and extenſive, however, it became neceſſary to adopt ſome regulations to prevent ſuch a cataſtrophe in time to come. It was now determined, that in all the new buildings to be erected, ſtone ſhould be uſed inſtead of timber. Wren was ordered by the king and grand-maſter to draw up the plan of a city with broad and regular ſtreets. Sir Chriſtopher Wren was appointed ſurveyor-general and principal architect for rebuilding the city, the cathedral of St Paul, and all the parochial churches enacted by parliament, in lieu of thoſe that were deſtroyed, with other public ſtructures. This gentleman, however, conceiving the charge to be too important for a ſingle perſon, ſelected for his aſſiſtant Mr Robert Hook profeſſor of geometry in Greſham college. The latter was immediately employed in meaſuring, adjuſting, and ſetting out the ground

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(A) Mr Preſton obſerves, that the grand-maſter of the north bears the title of *grand-maſter of all England*, which (ſays he) may probably have been occaſioned by the title of *grand-maſter*.

ground of the private ſtreets to the ſeveral proprietors. The model and plan were laid before the king and houſe of commons, and the practicability of the whole ſcheme, without any infringement of private property: but unfortunately it happened, that the greater part of the citizens were totally averſe to leaving their old habitations, and building houſes in other places; and ſo obſtinate were they in their determinations, that they choſe rather to have their old city again under all its diſadvantages, than a new one upon the improved plan. Thus an opportunity was loſt of making the new city the moſt magnificent as well as the moſt convenient for health and commerce of any in Europe. Hence the architect, bein cramped in the execution of has plan, was obliged to alter and abridge it, and to model the city after the manner in which it has ſince appeared.—In 1673 the foundation ſtone of the cathedral of St Paul's was laid with great ſolemnity by the king in perſon, and the mallet which he uſed on this occaſion is ſtill preſerved in the lodge of Antiquity as a great curioſity.

During the time that the city was rebuilding, lodges were held by the fraternity in different places, and many new ones conſtituted, to which the beſt architects reſorted. In 1674, earl Rivers reſigned the office of grand-maſter in favour of George Villiers duke of Buckingham, who left the care of the fraternity to his wardens, and Sir Chriſtopher Wren who ſtill continued to act as deputy. In 1679, the duke reſigned in favour of Henry Bennet earl of Arlington: but this nobleman was too deeply engaged in ſtate affairs to attend to his duty as a maſon, though the lodges continued to meet under his ſanction, and many reſpectable gentlemen joined the fraternity. During the ſhort reign of James II. the maſons were much neglected. In 1685, Sir Chriſtopher Wren was elected to the office of grand-maſter, who appointed Gabriel Cibber and Mr Edward Strong his wardens: yet notwithſtanding the great reputation and abilities of this celebrated architect, maſonry continued in a declining way for many years, and only a few lodges were held occaſionally in different parts of the kingdom.

At the Revolution, the ſociety was in ſuch a low ſtate in the ſouth of England, that only ſeven regular lodges were held in London and its ſuburbs; and of theſe only two, viz. that of St Paul's and one at St Thomas's hoſpital, Southwark, were of any conſeqnence. But in 1695 king William having been initiated into the myſteries, honoured the lodges with his preſence, particularly one at Hampton-court, at which he is ſaid to have frequently preſided during the time that the new part of his palace was building. Many of the nobility alſo were preſent at a general aſſembly and feaſt held in 1698, particularly Charles duke of Richmond and Lenox, who was elected grand-maſter for that year; but in 1698 reſigned his office to Sir Chriſtopher Wren, who continued at the head of the fraternity till King William's death in 1702.

During the reign of Queen Anne, maſonry made no conſiderable progreſs. Sir Chriſtopher's age and infirmities drew off his attention from the duties of his office, the annual feſtivals were entirely neglected, and the number of maſons conſiderably diminiſhed. It was therefore determined that the privileges of maſonry ſhould not be confined to operative maſons, but that people of all profeſſions ſhould be admitted to participate in them, provided they were regularly approved and initiated into the order.

Thus the ſociety once more roſe into eſteem; and on the acceſſion of George I. the maſons, now depirved of Sir Chriſtopher Wren, reſolved to unite again under a grand-maſter, and revive the annual feſtivals. With this view, the members of the only four lodges at that time exiſting in London, met at the Apple-tree tavern in Charles-ſtreet Covent Garden; and having voted the oldeſt maſter-maſon then preſent into the chair, conſtituted themſelves a grand-lodge *pro tempore*. It was now reſolved to renew the quarterly communications among the brethren; and at an annual meeting held on the 24th of June the ſame year, Mr Anthony Sayer was elected grand-maſter, inveſted by the oldeſt maſter-maſon there preſent, inſtalled by the maſter of the oldeſt lodge, and had due homage paid him by the fraternity. Before this time a ſufficient number of maſons, met together within a certain diſtrict, had ample power to make maſons without a warrant of conſtitution: but it was now determined, that the privilege of aſſembling as maſons ſhould be veſted in certain lodges or aſſemblies of maſons convened in certain places, and that every lodge to be afterwards convened, excepting the four old lodges then exiſting, ſhould be authorized to act by a warrant from the grand-maſter for the time, granted by petition from certain individuals, with the conſent and approbation of the grand-lodge in communication; and that without ſuch warrant no lodge ſhould hereafter be deemed regular or conſtitutional. The former privileges, however, were ſtill allowed to remain to the four old lodges then extant. In conſequence of this, the old maſons in the metropolis veſted all their inherent privileges as individuals in the four old lodges, in truſt that they never would ſuffer the ancient charges and land-marks to be infringed. The four old lodges, on their part, agreed to extend their patronage to every new lodge which ſhould hereafter be conſtituted according to the new regulations of the ſociety; and while they acted in conformity to the ancient conſtitutions of the order, to admit their maſters and wardens to ſhare with them all the privileges of the grand-lodge, that of precedence only excepted.

Matters being thus ſettled, the brethren of the four old lodges conſidered their attendance on the future communications of the ſociety as unneceſſary; and therefore truſted implicitly to their maſters and wardens, ſatisfied that no meaſure of importance would be adopted without their approbation. It was, however, ſoon diſcovered, that the new lodges being equally repreſented with the old ones at the communications, would at length ſo far outnumber them, that by a majority they might ſubvert the privileges of the original maſons of England which had been centered in the four old lodges; on which account a code of laws was, with the conſent of the brethren at large, drawn up for the future government of the ſociety. To this the following was annexed, binding the grand maſter for the time being, his ſucceſſors, and the maſter of every lodge to be hereafter conſtituted, to preſerve it inviolably, "Every annual grand-lodge has an inherent power and authority to make new regulations, or to alter theſe for the real benefit of this ancient fraternity, provided always that the old landmarks be carefully preſerved: and that ſuch alterations and new regulations be propoſed and agreed to at the third quarterly communication preceding the annual grand feaſt; and that they be offered alſo to the peruſal of all the brethren before dinner, in writing, even of the youngeſt apprentice; the approbation and conſent of the majority of all the brethern preſent being abſolutely neceſſary to make the ſame binding and obligatory." To commemorate this circumſtance, it has been cuſtomary, ever ſince that time, for the maſter of the oldeſt lodge to attend every grand inſtallation; and, taking precedence of all preſent, the grand-maſter only excepted, to deliver the book of the original conſtitutions to the new inſtalled grand-maſter, on his promiſing obedience to the ancient charges and general regulations.

By this precaution the original conſtitutions were eſtabliſhed as the baſis of all ſucceeding maſonic juriſdiction in the ſouth of England; and the ancient *land marks*, as they are called, or the boundaries ſet up as checks againſt innovation, were carefully ſecured from the attacks of any future invaders. No great progreſs however, was made during the adminiſtration of Mr Sayer, only two lodges being conſtituted, though ſeveral brethren joined the old ones. In 1718 Mr Sayer was ſucceeded by Mr George Payne, who collected many valuable manuſcripts on the ſubject of maſonry, and earneſtly requeſted, that the fraternity would bring to the grand lodge any old writings or records concerning the fraternity, to ſhow the uſages of ancient times; and in conſequence of this invitation, ſeveral old copies of the Gothic conſtitutions were produced, arranged, and digeſted. Another aſſembly and feaſt were held on the 24th of June 1719, when Dr Deſaguliers was unanimouſly elected grand-maſter. At this feaſt the old, regular, and peculiar toaſts were introduced; and from this time we may date the riſe of free-maſonry on its preſent plan in the ſouth of England. Many new lodges were eſtabliſhed, the old ones viſited by many maſons who had long neglected the craft, and ſeveral noblemen initiated into the myſteries. In 1720, however, the fraternity ſuſtained an irreparable loſs by the burning of ſeveral valuable manuſcripts, concerning the lodges, regulations, charges, ſecrets, &c. (particularly one written by Mr Nicholas Stone, the warden under Inigo Jones). This was done by ſome ſcrupulous brethren, who were alarmed at the publication of the maſonic conſtitutions. At a quarterly communication it was this year agreed, that, for the future, the new grand-maſter ſhall be named and propoſed to the grand lodge ſome time before the feaſt; and if approved and preſent, he ſhall be ſaluted as grand-maſter elect; and that every grand-maſter, when he is inſtalled, ſhall have the ſole power of appointing his deputy and wardens according to ancient cuſtom.

In the mean time maſonry continued to ſpread in the north as well as the ſouth of England. The general aſſembly, or grand lodge at York, continued to meet as uſual. Several lodges met in 1705, under the direction of Sir John Tempeſt baronet, then grand maſter; and many perſons of worth and character were initiated into the myſteries of the fraternity. The greateſt harmony ſubſiſted between the two grand lodges, and private lodges were formed in both parts of the kingdom under their ſeparate juriſdiction. The only diſtinction which the grand lodge in the north appears to have retained is in the title of the *Grand-Lodge of all England;* while the other was only called the *Grand Lodge of England.* The latter, however, being encouraged by ſome of the principal nobility, ſoon acquired conſequence and reputation, while the other ſeemed gradually to decline; but, till within theſe few years, the authority of the grand lodge at York was never challenged; on the other hand, every maſon in the kingdom held that aſſembly in the higheſt veneration, and conſidered himſelf bound by the charges which originated from that aſſembly. It was the glory and boaſt of the brethren in almoſt every country where maſonry was eſtabliſhed to be accounted deſcendants of the original York maſons: and from the univerſality of the idea that maſonry was firſt eſtabliſhed at York, by charter, the maſons of England have received tribute from the firſt ſtates in Europe. At preſent, however, this ſocial intercourſe is aboliſhed, and the lodges in the north and ſouth are almoſt entirely unknown to one another: and neither the lodges of Scotland nor Ireland court the correſpondence of the grand lodge at London. This is ſaid to have been owing to the introduction of ſome innovations among the lodges in the ſouth; but for the coolneſs which ſubſiſts between the two grand lodges another reaſon is aſſigned. A few brethren at York having, on ſome trivial occaſion, ſeceded from their ancient lodge, they applied to London for a warrant of conſtitution. Their application was honoured without any inquiry into the merits of the caſe; and thus, inſtead of being recommended to the mother lodge to be reſtored to favour, theſe brethren were encouraged to revolt, and permitted, under the ſanction of the grand lodge in London, to open a new lodge in the city of York itſelf. This illegal extenſion of power juſtly offended the grand lodge at York; and occaſioned a breach which has never yet been made up.

The duke of Buccleugh, who in 1723 ſucceeded the duke of Wharton as grand-maſter, firſt propoſed a ſcheme of raiſing a general fund for diſtreſſed maſons. The duke's motion was ſupported by Lord Paiſley, Colonel Houghton, and a few other brethren; and the grand lodge appointed a committee to conſider of the moſt effectual means of carrying the ſcheme into execution. The diſpoſal of the charity was firſt veſted in ſeven brethren; but this number being found too ſmall, nine more were added. It was afterwards reſoved that 12 maſters of contributing lodges, in rotation with the grand officers, ſhould form the committee; and by another regulation ſince made, it has been determined that at all paſt and preſent grand officers, with the maſters of all regular lodges which ſhall have contributed within 12 months to the charity, ſhall be members of the committee. This committee meets four times in the year by virtue of a ſummons from the grand maſter or his deputy. The petitions of the diſtreſſed brethren are conſidered at theſe meetings; and if the petitioner be conſidered as a deſerving object, he is immediately relieved with five pounds. If the circumſtances of the caſe are of a peculiar nature, his petition is referred to the next communication, where he is relieved with any ſum the committee may have ſpecified, not exceeding 20 guineas at one time. Thus the diſtreſſed have always found ready relief from this general charity, which is ſupported by the voluntary contributions of different lodges out of their private funds, without being burdenſome to any member in the ſociety. Thus has the committee of charity for free maſons been eſtabliſhed; and ſo liberal have the contributions been; that though the ſums annually expended for the relief of the diſtreſſed brethren have for ſeveral years paſt amounted to many thouſand pounds, there ſtill remains a conſiderable ſum.

The moſt remarkable events which of late have taken place in the affairs of maſonry, are the initiation of Omitul Omrah Bahauder, eldeſt ſon of the nabob of the Carnatic, who was received by the lodge of Trinchinopoply in the year 1779. The news being officially tranſmitted to England, the grand lodge determined to ſend a congratulatory letter to his highneſs on the occaſion, accompanied with an apron elegantly decorated, and a copy of the book of Conſtitutions ſuperbly bound. The execution of this commiſſion was entruſted to Sir John Duy; advocate-general of Bengal; and in the beginning of 1780, an anſwer was received from his highneſs acknowledging the receipt of the preſent, and expreſſing the warmeſt attachment and benevolence to his brethren in England. The letter was written in the Perſian language, and incloſed in an elegant cover of cloth of gold, and addreſſed to the grand maſter and grand lodge of England. A proper reply was made: and a tranſlation of his highneſs's letter was ordered to be copied on vellum; and, with the original, elegantly framed and glazed, and hung up in the hall at every public meeting of the ſociety.

After ſuch a long hiſtory of the riſe and progreſs of maſonry, it muſt be natural to inquire into the uſe of the inſtitution, and for what purpoſe it has been patroniſed by ſo many great and illuſtrious perſonages. The profound ſecrecy, however, in which every thing relating to maſonry is involved, prevents us from being very particular on this head. The maſons themſelves ſay, in general, that it promotes philanthropy, friendſhip, and morality; that in proportion as maſonry has been cultivated, the countries have been civilized, &c. How far this can be depended upon, the fraternity themſelves beſt know. Another advantage, however, ſeems leſs equivocal, viz. that its ſigns ſerve as a kind of univerſal language, ſo that by means of them, people of the moſt diſtant nations may become acquainted, and enter into friendſhip with one another. This certainly muſt be accounted a very important circumſtance; and conſidering the great number which have been, and daily are, admitted to the ſociety, and their inviolable attachment to the art, we muſt certainly conclude, that if it contains nothing of great importance to mankind at large, it muſt at leaſt be extremely agreeable, and even faſcinating to thoſe who are once initiated.

Egyptian MASONRY, a new ſyſtem of maſonry taught by the celebrated impoſtor the Count Caglioſtro.—It is not known whether this ſyſtem was an invention of his own, or whether any ſuch thing really has an exiſtence among the ſuperſtitious Egyptians. The ſcheme was firſt put in execution in London; and by means of his pretended knowledge in the myſteries of this art, the Count procured great ſums of money, and attached to himſelf a vaſt number of followers. The following particulars concerning it were confeſſed by him before the inquiſition at Rome.

The Egyptian maſons are divided into ſeveral ſects, but there are two more eſteemed than the reſt. The firſt is that of the adepts, the members of which (ſay the inquiſitors) profeſs the moſt irreligious ſentiments, and employ magic in their operations; but their principal object is the deſtruction of the Catholic religion and monarchy. The members of the other pretend to be occupied about the ſecrets of the hermetic art, and more eſpecially the philoſopher's ſtone. Caglioſtro owned that he was aſſociated in London with the ſecond of theſe ſects; that his wife was likewiſe a member, and received a diploma, which coſt five guineas. The lady was preſented with a ribbon, on which were embroidered the words *Union*, *Silence*, and *Virtue*; and ſhe was deſired to ſleep the following night with the ribbon attached to her thigh. When a male candidate is to be admitted, his courage muſt be tried in a number of ways. Caglioſtro himſelf ſubmitted to theſe trials; among which the following are mentioned in the account of his life. He was firſt hoiſted up to the ceiling by means of a pulley, and after ſuffering conſiderable pain, had his hand ſcorched by means of a candle. His eyes were then covered with a bandage, and he received an empty piſtol, with orders to charge it. This being done, he was ordered to diſcharge it againſt his head; and upon his refuſing to do ſo, the piſtol was taken from him with contempt, but returned after a number of ceremonies. This had ſuch an effect upon him, that without any regard to ſelf-preſervation, he drew the trigger, and got a ſmart ſtroke on the ſkull, which, however, produced no bad conſequence. At the initiation of other candidates, he diſcovered that the piſtol was changed, an unloaded one being put into the hands of the perſon when blind folded, and that one of the aſſiſtants ſtruck him a ſmart blow on his head, to make him think himſelf wounded. The ceremony was concluded with his taking an oath of ſecrecy and obedience to the grand-maſter.

MASORA, a term in the Jewiſh theology, ſignifying a work on the Bible, performed by ſeveral learned rabbins, to ſecure it from any alterations which might otherwiſe happen.

Their work regards merely the letter of the Hebrew text, in which they have, firſt, fixed the true reading by vowels and accents; they have ſecondly, numbered not only the chapters and ſections, but the verſes, words, and letters of the text; and they find in the Pentateuch 5245 verſes, and in the whole Bible 23206. The maſora is called, by the Jews, the *hedge or ſcence of the law*, becauſe this enumeration of the verſes, &c. is a means of preſerving it from being corrupted and altered. They have, thirdly, marked whatever irregularities occur in any of the letters of the Hebrew text; ſuch as the different ſize of the letters, their various poſitions and inverſions, &c. and they have been fruitful in finding out reaſons for theſe irregularities and myſteries in them They are, fourthly, ſuppoſed to

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be the authors of the Keri and Chetibh, or the marginal corrections of the text in our Hebrew Bibles.

The text of the ſacred books, it is to be obſerved, was originally written without any breaks or diviſions into chapters or verſes, or even into words; ſo that a whole book, in the ancient manner, was but one continued word: of this kind we have ſtill ſeveral ancient manuſcripts, both Greek and Latin. In regard therefore, the ſacred writings had undergone an infinite number of alterations, whence various readings had ariſen, and the original was become much mangled and diſguiſed, the Jews had recourſe to a canon, which they judged infallible, to fix and aſcertain the reading of the Hebrew text; and this rule they call *maſora*, "tradition," from מסר, *tradidit*, as if this critique were nothing but a tradition which they had received from their forefathers. Accordingly they ſay, that when God gave the law to Moſes at Mount Sinai, he taught him, firſt, the true reading of it; and, ſecondly, its true interpretation, and that both theſe were handed down by oral tradition, from generation to generation, till at length they were committed to writing. The former of theſe, viz. the true reading is the ſubject of the maſora; the latter, or true interpretation, that of the miſhna and gemara.

According to Elias Levita, they were the Jews of a famous ſchool at Tiberias, about 500 years after Chriſt, who compoſed, or at leaſt began the maſora; whence they are called *maſorites* and *maſoretic doctors*. Aben Ezra makes them the authors of the points and accents in the Hebrew text, as we now find it; and which ſerve for vowels.

The age of the maſorites has been much diſputed. Archbiſhop Uſher places them before Jerom; Capel, at the end of the fifth century; father Morin, in the tenth century. Baſnage ſays, that they were not a ſociety, but a ſucceſſion of men; and that the maſora is the work of many grammarians, who, without aſſociating and communicating their notions, compoſed this collection of criticiſms on the Hebrew text. It is urged that there were maſorites from the time of Ezra and the men of the great ſynagogue, to about the year of Chriſt 1030; and that Ben Aſher and Ben Naphtali, who were the beſt of the profeſſion, and who, according to Baſnage, were the inventors of the maſora, flouriſhed at this time. Each of theſe publiſhed a copy of the whole Hebrew text, as correct, ſays Dr Prideaux, as they could make it. The eaſtern Jews have followed that of Ben Naphtali, and the weſtern that of Ben Aſher; and all that has been done ſince is to copy after them, without making any more corrections, or maſoretical criticiſms.

The Arabs have done the ſame thing by their Koran that the maſorites have done by the Bible; nor do the Jews deny their having borrowed this expedient from the Arabs, who firſt put it in practice in the ſeventh century.

There is a great and little maſora printed at Venice and at Baſil, with the Hebrew text in a different character. Buxtorf has written a maſoretic commentary, which he calls *Tiberias*.

MASQUE, or **Mask**, a cover for the face, contrived with apertures for the eyes and mouth; originally worn chiefly by women of condition either to preſerve their complexion from the weather, or out of modeſty to prevent their being known. Poppæa, wife of Nero, is ſaid to be the firſt inventor of the *maſque*; which ſhe did to guard her complexion from the ſun and weather, as being the moſt delicate woman with regard to her perſon, that has been known.

Theatrical maſques were in common uſe both among the Greeks and Romans; Suidas and Athenæus aſcribe the invention of them to the poet Chœrilus, a contemporary of Theſpis; Horace attributes them to Æſchylus; but Ariſtotle informs us, that the real inventor, and conſequently the time of their firſt introduction and uſe, were unknown. Brantome obſerves, that the common uſe of modern maſques was not introduced till towards the end of the ſixteenth century.

Masque is alſo uſed to ſignify any thing uſed to cover the face, and prevent a perſon's being known. The penitents of Lyons and Avignon hide their faces with large white veils, which ſerve them for maſques.

The Iron Maſque (Maſque de Fer), or *Man with the iron maſque*, a remarkable perſonage ſo denominated, who exiſted as a ſtate priſoner in France during the latter part of the laſt century. As the circumſtances of this perſon form a hiſtorical problem which has occaſioned much inquiry, and given riſe to many conjectures, as well as of late, in conſequence of the deſtruction of the Baſtile, excited in a particular manner the curioſity of the public, it ſhall be endeavoured to condenſe in this article the ſubſtance of every thing material that has been publiſhed on the ſubject. We ſhall firſt relate ſuch particulars concerning this extraordinary priſoner as appear to be well authenticated; and ſhall afterwards mention the different opinions and conjectures that have been entertained with regard to his real quality, and the cauſes of his confinement.

1. The authenticated particulars concerning the *iron Maſque* are as follows;— a few months after the death of Cardinal Mazarine, there arived at the iſle of Sainte Marguerite, in the ſea of province, a young priſoner whoſe appearance was peculiarly attracting; his perſon was above the middle ſize, and elegantly formed; his mien and deportment were noble, and his manners graceful; and even the ſound of his voice, it is ſaid, had in it ſomething uncommonly intereſting. On the road he conſtantly wore a maſk made with iron ſprings to enable him to eat without taking it off. It was at firſt believed that this maſque was made entirely with iron, whence he acquired the name of "the Man with the iron maſk." His attendants had received orders to diſpatch him if he attempted to take of his maſque to diſcover himſelf.—He had been firſt confined at Pigneol, under the care of the governor M. de St Mars; and upon being ſent from thence to Sainte Marguerite, he was accompanied thither by the ſame perſon, who continued to have the charge of him. He was always treated with the moſt marked reſpect: he was ſerved conſtantly in plate; and the governor himſelf placed his diſhes on the table, retiring immediately after and locking the door behind him. He *tu to'yoit* (thee'd and thou'd) the governor; who, on the other hand, behaved to him in the moſt reſpectful manner, and never wore his hat before him, nor ſat down in his preſence unleſs he was deſired. The Marquis de Louvoiſis, who went to ſee him at St Marguerite, ſpoke to him ſtanding, and with that kind of attention which denotes high reſpect.

During his reſidence here, he attempted twice, in an indirect manner, to make himſelf known. One day he wrote ſomething with his knife on a plate, and threw it out of his window towards a boat that was drawn on ſhore near the foot of the tower. A fiſherman picked it up and carried it to the governor. M. de St Mars was alarmed at the ſight; and aſked the man with great anxiety, whether he could not read, and whether any one elſe had ſeen the plate? The man anſwered, that he could not read, that he had but juſt found the plate, and that no one elſe had ſeen it. He was, however, confined till the governor was well aſſured of the truth of his aſſertions.—Another attempt to diſcover himſelf proved equally unſucceſsful. A young man who lived in the iſle, one day perceived ſomething floating under the priſoner's window; and on picking it up, he diſcovered it to be a very fine ſhirt written all over. He carried it immediately to the governor; who, having looked at ſome parts of the writing, aſked the lad, with ſome appearance of anxiety, if he had not had the curioſity to read it? He proteſted repeatedly that he had not: but two days afterwards he was found dead in his bed.

The *Maſque de Fer* remained in this iſle till the year 1698, when M. St Mars being promoted to the government of the Baſtile, conducted his priſoner to that fortreſs. In his way thither, he ſtopt with him at his eſtate near Palteau. The Maſque arrived there in a litter, ſurrounded by a numerous guard on horſeback. M. de St Mars eat at the ſame table with him all the time they reſided at Palteau; but the latter was always placed with his back towards the windows; and the peaſants, who came to pay their compliments to their maſter, and whom curioſity kept conſtantly on the watch, obſerved that M. de St Mars always ſat oppoſite to him with two piſtols by the ſide of his plate. They were waited on by one ſervant only, who brought in and carried out the diſhes, always carefully ſhutting the door both in going out and returning. The priſoner was always maſked, even when he paſſed through the court; but the people ſaw his teeth and lips, and alſo obſerved that his hair was grey.—The governor ſlept in the ſame room with him, in a ſecond bed that was placed in it on that occaſion. In the courſe of their journey, the iron-maſk was, one day, heard to aſk his keeper whether the king had any deſign on his life? "No, Prince," he replied; "provided that you quietly allow yourſelf to be conducted, your life is perfectly ſecure."

The ſtranger was accommodated as well as it was poſſible to be in the Baſtile. An apartment had been prepared for him by order of the governor before his arrival, fitted up in the moſt convenient ſtyle; and every thing he expreſſed a deſire for was inſtantly procured him. His table was the beſt that could be provided; and he was ordered to be ſupplied with as rich clothes as he deſired: but his chief taſte in this laſt particular was for lace, and for linen remarkably fine. It appears that he was allowed the uſe of ſuch books as he deſired, and that he ſpent much of his time in reading. He alſo amuſed himſelf with playing upon the guitar. He had the liberty of going to maſs; but was then ſtrictly forbid to ſpeak or uncover his face: orders were even given to the ſoldiers to fire upon him if he attempted either; and their pieces were always pointed towards him as he paſſed through the court. When he had occaſion to ſee a ſurgeon or a phyſician, he was obliged, under pain of death, conſtantly to wear his maſk. An old phyſician of the Baſtile, who had often attended him when he was indiſpoſed, ſaid, that he never ſaw his face, though he had frequently examined his tongue, and different parts of his body; that there was ſomething uncommonly intereſting in the ſound of his voice; and that he never complained of his confinement, nor let fall from him any hint by which it might be gueſſed who he was. It is ſaid that he often paſſed the night in walking up and down his room.

This unfortunate prince died on the 19th of November 1703, after a ſhort illneſs; and was interred next day in the burying-place of the pariſh of St Paul. The expence of his funeral amounted only to forty livres. The name given him was *Marchiali*: and even his age, as well as his real name, it ſeemed of importance to conceal; for in the regiſter made of his funeral, it was mentioned that he was about forty years old; though he had told his apothecary, ſome time before his death, that he thought he muſt be ſixty.—It is a well known fact, that immediately after the priſoner's death, his apparel, linen, clothes, matraſſes; and in ſhort every thing that had been uſed by him, were burnt; that the walls of his room were ſcraped, the floor taken up, evidently from the apprehenſion that he might have found means of writing any thing that would have diſcovered who he was. Nay ſuch was the fear of his having left a letter or any mark which might lead to a diſcovery, that his plate was melted down; the glaſs was taken out of the window of his room and pounded to duſt; the window-frame and doors burnt; and the ceiling of the room, and the plaſter of the inſide of the chimney, taken down. Several perſons have affirmed, that the body was buried without a head; and Monſieur de Saint Foix informs us†, that "a gentleman having bribed the ſexton, had the body taken up in the night, and found a ſtone inſtead of the head."

The reſult of theſe extraordinary accounts is, that the iron maſque was not only a perſon of high birth, but muſt have been of great conſequence; and that his being concealed was of the utmoſt importance to the king and miniſtry. We come now, therefore, to notice.

II. The opinions and conjectures that have been formed concerning the real name and condition of this remarkable perſonage. Some have pretended that he was the duke of Beaufort; others, that he was the Count de Vermandois, natural ſon to Louis XIV. by the dutcheſs de la Valliere. Some maintain him to have been the duke of Monmouth, natural ſon of Charles II. of England by Lucy Walters; and others ſay, that he was Gerolami Magni, miniſter to the duke of Modena.

Beſides theſe conjectures, none of which poſſeſſes ſufficient probability to entitle them to conſideration, a fifth has been advanced namely, That the Iron Maſque was a ſon of Anne of Auſtria, queen to Louis XIII. and conſequently that he was a brother of Louis XIV.; but whether a baſtard brother, a bro-

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† In his *Eſſais Hiſtoriques.*

ther-german, or a half brother, is a queſtion that has given riſe to three ſeveral opinions, which we ſhall ſtate in the order of time in which the reſpective tranſactions to which they allude happened.

1. The firſt opinion is, that the queen proved with child at a time when it was evident it could not have been by her huſband, who, for ſome months before, had never been with her in private. The ſuppoſed father of this child is ſaid by ſome to have been the duke of Buckingham, who came to France in May 1625, to conduct the princeſs Henrietta, wife of Charles I. to England. The private letters and memoires of thoſe times ſpeak very ſuſpiciouſly of the queen and Buckingham: his behaviour at Amiens, whither the queen and queen-mother accompanied the princeſs in her way to Boulogne, *occaſioned much whiſpering*: notwithſtanding the pains that have been taken by La Porte in his *Memoirs* to excuſe his miſtreſs, it appears that the king, on this occaſion, was extremely offended at her, and that it required all the influence and addreſs of the queen-mother to effect a reconciliation. It is ſaid, that this child was privately brought up in the country; that when Mazarin became a favourite, he was entruſted with the care of him; and that Louis XIV. having diſcovered the ſecret on the death of the cardinal, thought it neceſſary to confine him in the manner that has been related.

Hiſt. of the Baſtile, n° 6. p. 343.

But it may be obſerved, that this ſecret could ſcarcely have eſcaped the vigilance of the cardinal de Richlieu; and it is not improbable, that a miniſter ſo little ſcrupulous, if inclined to ſave the honour of a queen, would have removed a child, who, if he lived, might have been made uſe of to diſturb the tranquillity of the kingdom. After this ſuppoſed birth, the queen had frequent quarrels with the king, and, what was more dangerous, with the cardinal; who even uſed every means in his power to inquire into her moſt private tranſactions. It was on a memorable occaſion of this kind, that her ſervant La Porte was thrown into the Baſtile; and it can ſcarcely be imagined ſhe would have had the firmneſs ſhe then diſplayed, while conſcious of ſo much guilt, and under the riſk of having it diſcovered. The priſoner with the maſque appears, by ſeveral accounts, to have been a youth of a handſome figure in the year 1661; and in 1703, when he died, to have been above ſixty; but had he been a ſon of Buckingham, he would have been about thirty-ſix in 1661, when he could not be ſaid to have been a youth; and in November 1703, above ſeventy-eight.

2. The ſecond opinion is, that he was the twin-brother of Louis XIV born ſome hours after him. This firſt appeared in a ſhort anonymous work publiſhed without date, and without the name of place or printer. It is therein ſaid, "Louis XIV. was born at St Germains en Laye, on the 5th of September 1638, about noon; and the illuſtrious priſoner, known by the appellation of the *Iron maſque*, was born the ſame day, while Louis XIII. was at ſupper The king and the cardinal, fearing that the pretenſions of a twin-brother might one day be employed to renew thoſe civil wars with which France had been ſo often afflicted, cautiouſly concealed his birth, and ſent him away to be brought up privately. Having but an imperfect knowledge of the circumſtances that followed, I ſhall ſay nothing more, for fear of committing errors; but I firmly believe the fact I have mentioned; and time will probably prove to my reader, that I have ground for what I have advanced."

This opinion has been more noticed ſince the publication of a work called *Memoirs du Marechal Duc de Richlieu*, written by the Abbé Soulavie; concerning which it may be proper to premiſe, that the preſent duke of Richlieu, ſon of the marechal, diſavows this work; while the Abbê Soulavie, who had been employed by the marechal, inſiſts on the authenticity of his papers (A.). He informs us, that the duke of Richlieu was the lover of Mademoiſelle de Valois, daughter of the regent duke of Orleans, and afterwards ducheſs of Modena, who in return was paſſionately fond of him: that the regent had ſomething more than a paternal affection for his daughter; and that, though ſhe held his ſentiments in abhorrence, the duke of Richlieu made uſe of her influence with her father to diſcover the ſecret of the priſoner with the maſque: that the regent, who had always obſerved the moſt profound ſilence on this ſubject, was at laſt perſuaded to entruſt her with a manuſcript, which ſhe immediately ſent to her lover, who took a copy of it. This manuſcript is ſuppoſed to have been written by a gentleman on his death-bed, who had been the governor of the priſoner. The following is an extract of it, from what the Abbé Soulavie has told us.

"The birth of the priſoner happened in the evening of the 5th of September 1638, in preſence of the chancellor, the biſhop of Meaux, the author of the manuſcript, a midwife named Peronéte, and a ſieur Honorat. This circumſtance greatly diſturbed the king's mind; he obſerved, that the Salique law had made no proviſion for ſuch a caſe; and that it was even the opinion of ſome, that the laſt born was the firſt conceived, and therefore had a prior right to the other. By the advice of cardinal de Richlieu, it was therefore reſolved to conceal his birth, but to preſerve his life, in caſe by the death of his brother it ſhould be neceſſary to avow him. A declaration was drawn up, and ſigned and ſworn to by all preſent, in which every circumſtance was mentioned, and ſeveral marks on his body deſcribed. This document being ſealed by the chancellor with the royal ſeal, was delivered to the king; and all were commanded and took an oath never to ſpeak on the ſubject, not even in private and among themſelves. The child was delivered to the care of Madame Peronéte the midwife, to be under the direction of cardinal de Richlieu, at whoſe death the charge devolved to cardinal de Mazarin. Mazarin appointed the author of the manuſcript his governor, and entruſted to him the care of his education. But as the priſoner was extremely attached to Madame Peronéte, and ſhe equally ſo to him, ſhe remained with him till her death. His governor carried him to his houſe in Burgundy,

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(A) A letter from the duke of Richlieu, and an anſwer from the Abbé Soulavie, appeared in the journal de Paris.

gundy, where he paid the greateſt attention to his education.

"As the priſoner grew up, he became impatient to diſcover his birth, and often importuned his governor on that ſubject. His curioſity had been rouſed, by obſerving that meſſengers from the court frequently arrived at the houſe; and a box, containing letters from the queen and the cardinal, having one day been inadverdently left out, he opened it, and ſaw enough to gueſs at the ſecret. From that time he became thoughtful and melancholy,' which (ſays the author) I could not then account for. He ſhortly after aſked me to get him a portrait of the late and preſent king, but I put him off by ſaying that I could not procure any that were good. He then deſired me to let him go to Dijon; which I have known ſince was with an intention of ſeeing a portrait of the king there, and of going ſecretly to John de Lus, where the court then was on occaſion of the marriage with the infanta. He was beautiful; and love helped him to accompliſh his wiſhes. He had captivated the affections of a young houſekeeper, who procured him a portrait of the king. It might have ſerved for either of the brothers; and the diſcovery put him into ſo violent a paſſion, that he immediately came to me with the portrait in his hand, ſaying, *Voila mon frere, et voila qui je ſuis*, ſhowing me at the ſame time a letter of the cardinal de Mazarine that he had taken out of the box.' Upon this diſcovery his governor immediately ſent an expreſs to court to communicate what had happened, and to deſire new inſtructions; the conſequence of which was, that the governor and the young prince under his care were arreſted and confined."

This memoir, real or fictitious, concludes with ſaying, "I have ſuffered with him in our common priſon: I am now ſummoned to appear before my Judge on high; and for the peace of my ſoul I cannot but make this declaration, which may point out to him the means of freeing himſelf from his preſent ignominous ſituation, in caſe the king his brother ſhould die without children. Can an extorted oath compel me to obſerve ſecrecy on a thing ſo incredible, but which ought to be left on record to poſterity.

3. The third opinion is, that he was a ſon of the queen by the cardinal de Mazarin, born about a year after the death of her huſband Louis XIII.; that he was brought up ſecretly; and that ſoon after the death of the cardinal, which happened on the 9th of March 1661, he was ſent to Pignerol. To this account Father Griffet* objects, "that it was needleſs to maſque a face that was unknown; and therefore that this opinion does not merit diſcuſſion. But in anſwer it has been obſerved, That the priſoner might ſtrongly reſemble Louis XIV. which would be a ſufficient reaſon to have him maſked. This opinion is ſuppoſed to have been that entertained by Voltaire, who aſſerts his thorough knowledge of the ſecret, though he declined being altogether explicit. The Abbé Soulavie, author of Memoirs of the Marechal de Richlieu, ſpeaking on this ſubject, ſays, "That he once obſerved to the Maréchal, that he certainly had the means of being informed who the priſoner was, that it even ſeemed that he had told Voltaire, who durſt not venture to publiſh the ſecret; and that he at laſt aſked him, whether he was not the elder brother of Louis XIV. born without the knowledge of Louis the XIII.? That the marechal ſeemed embarraſſed, but afterwards ſaid, that he was neither the baſtard brother of Louis the XIV. nor the duke of Monmouth, nor the count of Vermandois, nor the duke of Beaufort, as different authors had advanced; that their conjectures were nothing but reveries: but added, that they however had related many circumſtances that were true; that in fact the order was given to put the priſoner to death if he diſcovered himſelf; and that he finiſhed the converſation by ſaying, All I can tell you on the ſubject is, that the priſoner was not of ſuch conſequence when he died at the beginning of the preſent century as he had been at the beginning of the reign of Louis the XIV. and that he was ſhut up for important reaſons of ſtate." The Abbé Soulavie tells us, that he wrote down what had been ſaid, and gave it to the Marechal to read, who corrected ſome expreſſions. The Abbé having propoſed ſome further queſtions, he anſwered, "Read what Voltaire publiſhed laſt on the ſubject of the priſoner with the maſque, eſpecially at the end, and reflect on it."—The paſſage of Voltaire alluded to is as follows.

"The *man with the maſque* (ſays he) is an enigma of which every one would gueſs the meaning. Some have ſaid that it was the duke of Beaufort; but the duke of Beaufort was killed by the Turks in the defence of Candy in 1669, and the priſoner with the maſque was at Pignerol in 1661. Beſides, how could the duke of Beaufort have been arreſted in the midſt of his army, and brought to France, without any one knowing it? and why confine him? and why that maſk?—Others have dreamed that he was the count de Vermandois, natural ſon of Louis XIV. who died publicly at the army in 1683 of the ſmall-pox, and was buried at the little town of Aire and not Arras; in which Father Griffet was miſtaken, but in which to be ſure there is no great harm.—Others have imagined, that it was the duke of Monmouth, who was beheaded publicly in London in the year 1685. But for this he muſt have riſen again from the dead, and he muſt have changed the order of time, and placed the year 1662 in the room of the year 1685. King James, who never forgave any one, and who on that account deſerved all that happened to him, muſt have pardoned the duke of Monmouth, and got another to die in his ſtead, who perfectly reſembled him. This Soſia muſt firſt have been found, and then he muſt have had the goodneſs to let his head be cut off in public, to ſave the duke of Monmouth. It was neceſſary that all England ſhould be miſtaken; and that King James ſhould beg of Louis XIV. to be ſo obliging as to be his gaoler; that Louis XIV. after having ſhown this trifling piece of civility to King James, ſhould not have been wanting in the ſame attention to his friend King William and to Queen Anne (with both of whom he was engaged in war), and to pleaſe them, retained the dignity of goaler, with which James had honoured him.

"All theſe illuſions being diſſipated, it then remains to know who this priſoner was, and at what age he died. It is clear, that if he was not permitted to croſs the court of the Baſtile, or to ſpeak to his phyſician, except covered with a maſque, it muſt have been from the apprehenſion that his features and counte-

* *Traite de la Verite de l' Hiſtoire*, p. 318. n.

nance might have diſcovered ſome reſemblance. He could ſhow his tongue but not his face. He ſaid himſelf to the apothecary of the Baſtile, a few days before his death, that he believed he was about 60. Mr Marſoban, who was ſon-in-law to this apothecary, and ſurgeon to the marechal de Richelieu, and afterwards to the regent duke of Orleans, told me this frequently. Why give him an ITALIAN name?—They always called him *Marchiali*. He who writes this article perhaps knows more than Father Griffet, but he will ſay nothing farther."

This opinion has been lately reſumed, illuſtrated, and enforced by M. de Saint Mihiel, in a work intitled *Le Veritable Homme*, &c. "The real man with the Iron Maſque." The author, in ſupport of his idea, attempts to prove that Anne of Auſtria and Cardinal Mazarine were married. This, ſays he, the ducheſs of Orleans aſſures us in three of her letters. In the firſt, dated Sept. 13. 1713, ſhe expreſſes herſelf as follows: "Old Beauvais, who was firſt lady of the bed-chamber to the queen-dowager, was acquainted with the ſecret of the ridiculous marriage; this rendered it neceſſary for the queen to do every thing that her confidant wiſhed; and this circumſtance has given riſe in this country to an extenſion of the rights of firſt lady of the bedchamber." In the ſecond of theſe letters, dated Nov. 2. 1717, ſhe ſays, "The queen-mother, widow of Louis XIII. did worſe than love Cardinal Mazarine; ſhe married him, for he was not a prieſt: he was not even in orders; and who could have hindered her? He was moſt horribly tired of the good queen-mother, and lived on very bad terms with her, which is the reward that people deſerve from entering into ſuch marriages." In her third letter, dated July 2. 1719, ſpeaking of the queen, the ducheſs ſays, "She was perfectly eaſy reſpecting Cardinal Mazarine; he was not a prieſt, and therefore nothing could prevent their being married. The ſecret paſſage thro' which the cardinal went every evening to the queen's apartment, is ſtill to be ſeen at the Palais-Royal." Among other proofs beſides the above, which M. de St Mihiel brings to ſubſtantiate this marriage, he obſerves, that Mazarine held all councils of ſtate in his apartment whilſt he was ſhaving or dreſſing; that he never permitted any perſon to ſit down in his preſence, not even the chancellor nor marſhal de Villeroi; and that while they were deliberating with him on ſtate affairs he would be often playing with his monkey or linnet. What man (continues the author) would have ſubjected to ſuch humiliations a chancellor, who holds the firſt office in the kingdom ſince that of conſtable has been ſuppreſſed, and a marſhal who was a governor to the king, had he not been in reality a ſovereign himſelf, in virtue of his being huſband to the queen-regent? He therefore concludes, that the man with the iron maſque was ſon to Anne of Auſtria and Cardinal Mazarine; and endeavours to juſtify this aſſertion by a variety of conjectural proofs. Of ſome of theſe we ſhall give a ſhort ſketch:

1. No prince, or perſon of any conſideration, after the year 1644, at which time the man with the iron maſque was born, until the time when his exiſtence was known, diſappeared in France. This perſonage, therefore, was not a prince or great lord of France known at that time.

2. The man with the iron maſque was not a foreigner; for foreigners, even of the higheſt diſtinction, did not at that period ſtudy the French language in ſuch a manner as to attain ſo great perfection in it as to paſs for Frenchmen. If this priſoner had ſpoken with the leaſt foreign accent, the officers, phyſicians, ſurgeons, apothecaries, confeſſors, and others employed in the priſons where he was, and eſpecially the priſoners with whom he converſed at St Margaret, would not have failed to diſcover it. From all this M. de St Mihiel infers that he muſt have been a Frenchman.

3. The exiſtence of the man with the iron maſque has been known for upwards of 90 years. Had any perſon of high rank diſappeared at an anterior period, his friends, relations, or acquaintances, would not have failed to claim him, or at leaſt to ſuppoſe that he was the man concealed by this maſque. But no one diſappeared, nor was any one claimed: the man with the iron maſque was therefore a perſon unknown.

4. This man was not torn away from ſociety on account of any criminal action; for when he was arreſted, it was foreſeen that he would cauſe much embarraſſment, and occaſion great expences. He was therefore not a criminal, elſe means would have been purſued to get rid of him; and conſequently all the importance of his being concealed was attached ſolely to his perſon.

5. This ſtranger muſt have been a perſon of very high birth; for the governor of the priſon of St Mars behaved always to him with the greateſt reſpect.

6. Louis XIII. played on the guitar; Louis XIV. did the ſame in a very maſterly manner; and the man with the iron maſque played alſo on that inſtrument: which gives us reaſon to believe that his education was directed by the ſame perſons who had preſided over that of Louis XIV. and who appear to have been the particular choice of Anne of Auſtria.

7. This ſtranger died on the 19th of November 1703; and a few days before his death, he told the apothecary of the Baſtile, that he believed he was about 60 years of age. Suppoſing that he was then 59 and a half, he muſt have been born towards the end of May 1644; and if he was 60 wanting three months, he muſt have been born in the end of Auguſt, or the beginning of September, of the ſame year; a period when the royal authority was in the hands of Anne of Auſtria, but in reality exerciſed more by Mazarine than by her. "I have already proved (continues the author), that from the firſt day of the regency of Anne of Auſtria, the greateſt friendſhip, and even intimacy, ſubſiſted between this princeſs and the cardinal; that theſe ſentiments were changed into a mutual love; and that they were afterwards united by the bonds of marriage. They might, therefore, well have a ſon about the month of September 1664, as Louis XIII. had been then dead more than 15 months, having died on the 15th day of May the year preceding. But nothing of what I have related, or of what has been written, and acknowledged as fact, reſpecting the man with the iron maſk, can be applied, except to a ſon of Mazarine and Anne of Auſtria. The man with the iron maſk was indebted, therefore, for his exiſtence to cardinal Mazarine, and the regent widow of Louis XIII."—To account for the

the manner in which the queen was able to conceal her pregnancy and delivery, Madame de Moteville is quoted; "who relates, under the year 1644, that Anne of Auſtria quitted the Louvre, becauſe her apartments there diſpleaſed her: that ſhe went to reſide at the Palais-Royal, which Richlieu, when he died, bequeathed to the deceaſed king: that when ſhe firſt occupied this lodging, *ſhe was dreadfully afflicted with the jaundice:* that the phyſicians aſcribed this diſorder to her dejection and application to buſineſs, which gave her much embarraſſment: but that being cured of her melancholy, as well as her malady, ſhe reſolved to think only of enjoying tranquillity; which ſhe did, by communicating to her miniſter the burden of public affairs. On this quotation, M. de St Mihiel aſks, "Is it not very ſingular, that the queen who, during the 29 years of her former wedded ſtate, had always reſided in the Louvre, eſpecially from 1626, when Louis XIII. ceaſed to cohabit with her, until their re-union, which took place in the beginning of December 1637, ſhould have quitted it preciſely in 1644, becauſe ſhe was diſpleaſed with her apartments? How happened it that her apartments diſpleaſed her this year, and neither ſooner nor later? She might undoubtedly have had any kind of furniture there which ſhe deſired, and every alteration made according to her wiſhes, as ſhe was then abſolute miſtreſs: but the cauſe of her determination is plain; the apartments of the Palais-Royal, which front a garden, were much more convenient for her to be delivered in ſecret."

8. As it is neceſſary that ſome name ſhould be given to every man, in order to diſtinguiſh him from another, that of *Marchiali* was given to the man with the iron maſk: a name which evidently ſhows, that it had been invented by an Italian. [Cardinal Mazarine was a native of Piſcina in the Abruzzo.]

9. Anne of Auſtria was remarkably delicate reſpecting every thing that touched her perſon. It was with great difficulty that cambric could be found fine enough to make ſhifts and ſheets for her. Cardinal Mazarine once rallying her on that ſubject, ſaid, *That if ſhe ſhould be damned, her puniſhment in hell would be to ſleep in Holland ſheets.* The predominant taſte of the man with the iron maſque, was to have lace and linen of the moſt extraordinary fineneſs. "Who (ſays the author) does not perceive, in this ſimilarity of taſtes, the maternal tenderneſs of Anne of Auſtria, who would have thought her ſon a great ſufferer had he not been indulged with fine linen?"

"Louis XIII. (continues M. de St Mihiel) was a huſband of a gloomy diſpoſition, and an enemy to pleaſure: while the queen, on the contrary, was fond of ſocial life; and introduced at the court of France, eſpecially after ſhe became free, that eaſe and politeneſs which diſtinguiſhed it under Louis XIV. from all the other courts of Europe. Louis XIII. had alſo a diſagreeable countenance, and a breath ſo offenſive, that it was a puniſhment for Richlieu to remain near him. It is clear, therefore, that ſhe could not be much pleaſed with ſuch a huſband. When ſhe became regent of the kingdom by the king's death, which happened on the 14th of May 1643, as ſhe had not enjoyed that happineſs which ariſes from a cloſe union of hearts, it will not appear extraordinary that ſhe ſhould indulge the affection ſhe entertained for cardinal Mazarine, and that ſhe ſhould marry him. Every circumſtance that could tend to favour ſuch a marriage will be found united in her ſituation. She was at a diſtance from her family; abſolute miſtreſs of all her actions; and had, beſides, a heart formed for love. Mazarine, though a cardinal, had never entered into orders; he gave out that he was deſcended from a great family; he was handſome and well made; he was of a mild, inſinuating diſpoſition, and remarkably engaging in converſation; and his office, as a prime miniſter, afforded him every opportunity of viſiting and converſing with the queen whenever he thought proper. Is it, therefore, ſo very aſtoniſhing, that, with ſo many advantages, he was able to captivate the queen ſo far as to induce her to marry him? Such a marriage was not, indeed, according to the uſual courſe of things. Yet it was not without many precedents, particularly among ſovereigns of the other ſex, who had given their hands to perſons of inferior rank. Thus Chriſtian IV. of Denmark eſpouſed Chriſtina Monck; Frederick IV. eſpouſed Mademoiſelle Reventlaw; James II. heir to the throne of England, married the daughter of a counſellor; Peter the Great raiſed to the throne Catharine I. the daughter of a poor villager, yet perhaps the moſt accompliſhed woman at that time between the Viſtula and the pole; and Louis XIV. eſpouſed the widow of a poet, but a woman poſſeſſed of the moſt extraordinary merit. As the women, however, are not forgiven ſo readily as the men for entering into ſuch marriages, Anne of Auſtria kept hers a ſecret from this motive, and becauſe ſhe would have been in danger of loſing the regency of the kingdom had it been known.

The reaſoning of M. de St Mihiel is both ingenious and plauſible; though the probability of the account is ſomewhat diminiſhed by conſidering what muſt have been the queen's age at this period, after ſhe had been Louis's wife for 29 years before his death.—The account immediately preceding, without this objection, ſeems abundantly credible. But whether, upon the whole, either of them can be received as deciſive, or whether the myſtery of the iron maſk remains ſtill to be unravelled, we muſt leave to the reader to determine.

Masque, in architecture, is applied to certain pieces of ſculpture, repreſenting ſome hideous forms, groteſque, or ſatyrs, faces, &c. uſed to fill up and adorn vacant places, as in friezes, the pannels of doors, keys of arches, &c. but particularly in grottos.

MASQUERADE, or **Mascarade**, an aſſembly of perſons maſqued or diſguiſed, meeting to dance and divert themſelves. This was much in uſe in Britain, and has been long a very common practice on the continent of Europe, eſpecially in carnival time.

The word comes from the Italian *maſcarata*, and that from the Arabic *maſcara*, which ſignifies "raillery, buffoonery." Granacci, who died in 1543, is ſaid to have been the firſt inventor of maſquerades.

MASRAKITHA, a pneumatic inſtrument of muſic among the ancient Hebrews, compoſed of pipes of various ſizes, fitted into a kind of wooden cheſt, open at the top, and ſtopped at the bottom with wood covered with a ſkin. Wind was conveyed to it from the lips, by means of a pipe fixed to the cheſt: the pipes were of lengths muſically proportioned to each other, and the melody was varied at pleaſure, by ſtopping and unſtopping with the fingers the apertures at the upper extremity. See Plate CCLXXIX.

MASS, in mechanics, the matter of any body cohering with it, *i. e.* moving and gravitating along with it. In which ſenſe, *maſs* is diſtinguiſhed from bulk, or volume, which is the expanſion of a body in length, breadth, and thickneſs.

The maſs of any body is rightly eſtimated by its weight. And the maſſes of two bodies of the ſame weight are in a reciprocal ratio of their bulks.

Mass, *Miſſa*, in the church of Rome, the office or prayers uſed at the celebration of the euchariſt; or in other words conſecrating the bread and wine into the body and blood of Chriſt, and offering them ſo tranſubſtantiated as an expiatory ſacrifice for the quick and the dead.

As the maſs is in general believed to be a repreſentation of the paſſion of our bleſſed Savour, ſo every action of the prieſt, and every particular part of the ſervice, is ſuppoſed to allude to the particular circumſtances of his paſſion and death.

Nicod, after Baronius, obſerves that the word comes from the Hebrew *miſſach, (oblatum;)* or from the Latin *miſſa miſſorum;* becauſe in the former times, the catechumens and excommunicated were ſent out of the church, when the deacons ſaid, *Ite, miſſa eſt,* after ſermon and reading of the epiſtle and goſpel; they not being allowed to aſſiſt at the conſecration. Menage derives the word from *miſſio,* "diſmiſſing." Others from *miſſa,* "miſſing, ſending;" becauſe in the maſs, the prayers of men on earth are ſent up to heaven.

The general diviſion of maſſes conſiſts in high and low. The firſt is that ſung by the choriſters, and celebrated with the aſſiſtance of a deacon and ſub-deacon; low maſſes are thoſe in which the prayers are barely rehearſed without ſinging.

There are a great number of different or occaſional maſſes in the Romiſh church, many of which have nothing peculiar but the name: ſuch are the maſſes of the ſaints; that of St Mary of the ſnow, celebrated on the fifth of Auguſt; that of St Margaret, patroneſs of lying-in women; that of the feaſt of St John the Baptiſt, at which are ſaid three maſſes; that of the Innocents, at which the gloria in excelſis and the hallelujah are omitted, and it being a day of mourning, the altar is of a violet-colour. As to ordinary maſſes, ſome are ſaid for the dead, and, as is ſuppoſed, contribute to fetch the ſoul out of purgatory: at theſe maſſes the altar is put in mourning, and the only decorations are a croſs in the middle of ſix yellow wax-lights; the dreſs of the celebrant, and the very maſs-book, are black; many parts of the office are omitted, and the people are diſmiſſed without the benediction. If the maſs be ſaid for a perſon diſtinguiſhed by his rank or virtues, it is followed with a funeral oration; they erect a *chapelle ardente,* that is, a repreſentation of the deceaſed with branches and tapers of yellow wax, either in the middle of the church or near the deceaſed's tomb, where the prieſt pronounces a ſolemn abſolution of the deceaſed. There are likewiſe private maſſes ſaid for ſtolen or ſtrayed goods or cattle, for health, for travellers, &c. which go under the name of *votive maſſes.* There is ſtill a further diſtinction of maſſes denominated from the countries in which they were uſed; thus the Gothic maſs, or *miſſa moſarabum,* is that uſed among the Goths when they were maſters of Spain, and which is ſtill kept up at Toledo and Salamanca; the Ambroſian maſs is that compoſed by St Ambroſe, and uſed only at Milan, of which city he was biſhop; the Gallic maſs, uſed by the ancient Gauls; and the Roman maſs, uſed by almoſt all the churches in the Romiſh communion.

Mass of the Preſanctified, (miſſa præſanctificatorum), is a maſs peculiar to the Greek church, in which there is no conſecration of the elements; but after ſinging ſome hymns, they receive the bread and wine which was before conſecrated. This maſs is performed all Lent, except on Saturdays, Sundays, and the annunciation. The prieſt counts upon his fingers the days of the enſuing week on which it is to be celebrated, and cuts off as many pieces of bread at the altar as he is to ſay maſſes; and after having conſecrated them, ſteeps them in wine, and then puts them in a box; out of which, upon every occaſion, he takes ſome of it with a ſpoon, and putting it on a diſh ſets it upon the altar.

MASSA, a town of Italy, in the kingdom of Naples, and in the Terra di Lavoro, with a biſhop's ſee; ſeated on a mountain near the ſea, in E. Long. 10. N. Lat. 43. 5.

Massa, an ancient, populous, and handſome town of Italy, and capital of a ſmall territory of the ſame name, with the title of a principality, and a ſtrong caſtle. It is famous for its quarries of fine marble, and is ſituated in E. Long. 14. 23. N. Lat. 40. 40.

MASSACHUSETS state, the principal ſubdiviſion of New England, having Hampſhire on the north, the Atlantic ocean on the eaſt and ſouth, and Connecticut and New York on the weſt. It is about 100 miles long, and 40 broad. See *New England.*

MASSACRE, a term uſed to ſignify the ſudden and promiſcuous butchery of a multitude. The moſt atrocious example of this kind upon record is that called the *Pariſian Massacre,* or *Maſſacre of St Bartholomew's Day.* The Pariſian maſſacre was carried on with ſuch deteſtable perfidy, and executed with ſuch a bloody cruelty, as would ſurpaſs all belief, were it not atteſted by the moſt undeniable evidence. In the year 1572, in the reign of Charles IX. many of the principal proteſtants were invited to Paris, under a ſolemn oath of ſafety, upon occaſion of the marriage of the king of Navarre with the French king's ſiſter, viz. the king of Navarre's mother, Coligni admiral of France, with other nobles. The queen-dowager of Navarre, a zealous proteſtant, was poiſoned by a pair of gloves before the marriage was ſolemnized; and on the 24th of Auguſt 1572, being Bartholomew's day, about day-break, upon the toll of the bell of the church of St Germain the butchery began. The admiral was baſely murdered in his own houſe; and then thrown out of the window, to gratify the malice of the duke of Guiſe: his head was afterwards cut off, and ſent to the king and queen-mother; and his body, after a thouſand indignities offered to it, hung up by the feet on a gibbet. After this, the murderers ravaged the whole city of Paris, and butchered in three days above ten thouſand lords, gentlemen, preſidents, and people of all ranks. An horrible ſcene of things, ſays Thuanus, when the very ſtreets and paſſages reſounded with the noiſe of thoſe that met together for murder and plunder; the groans of thoſe who were dying, and the ſhrieks of ſuch as were juſt going to be butchered, were every where heard; the bodies of the ſlain thrown out of the windows; the courts and chambers of the houſes filled with them; the dead bodies of others dragged through the ſtreets, their blood running down the channels in ſuch plenty, that torrents ſeemed to empty themſelves in the neighbouring river; and, in a word, an innumerable multitude of men, women with child, maidens, and children, were all involved in one common deſtruction; and the gates and entrances of the king's palace all beſmeared with their blood.

From the city of Paris the maſſacre ſpread almoſt throughout the whole kingdom. In the city of Meaux they threw above two hundred into jail; and after they had raviſhed and killed a great number of women, and plundered the houſes of the proteſtants, they executed their fury on thoſe they had impriſoned, and calling them out one by one, they were killed, as Thuanus expreſſes, like ſheep in a market; the bodies of ſome were flung into ditches, and of others into the river Maine. In Orleans they murdered above five hundred men, women, and children, and enriched themſelves with their ſpoil. The ſame cruelties were practiſed at Angers, Troyes, Bourges, La Charité, and eſpecially at Lyons, where they inhumanly deſtroyed above eight hundred proteſtants; children hanging on their parents necks; parents embracing their children: putting ropes about the necks of ſome, dragging them through the ſtreets, and throwing them, mangled, torn, and half-dead, into the river.

It would be endleſs to mention the butcheries committed at Valence, Romaine, Rouen, &c. We ſhall, therefore, only add, that, according to Thuanus, above thirty thouſand proteſtants were deſtroyed in this maſſacre, or, as others with greater probability affirm, above one hundred thouſand.

Thuanus himſelf calls this a moſt deteſtable villainy; and, in abhorrence of St Bartholomew's day, uſed to repeat theſe words of P. Statius, Silv. v. iii. ver. 88. &c.

Excidat illa dies ævo, ne poſtera credant
Secula. Nos certe taceamus, et obruta multa
Nocte tegi propriæ patiamur crimina gentis.

In the words of Job, chap. iii. ver. 3. &c. "Let that day periſh; and let it not be joined unto the days of the year. Let darkneſs and the ſhadow of death ſtain it." &c. And yet, as though this had been the moſt heroic tranſaction, and could have procured immortal glory to the authors of it, medals were ſtruck at Paris in honour it.

But how was the news of this butchery received at Rome, that faithful city, that holy mother of churches! How did the vicar of Chriſt, the ſucceſſor of Peter, and the father of the Chriſtian world, reliſh it? Let Thuanus tell the horrid truth. When the news, ſays he, came to Rome, it was wonderful to ſee how they exulted for joy. On the 6th of September, when the letters of the pope's legate were read in the aſſembly of the cardinals, by which he aſſured the Pope that all was tranſacted by the expreſs will and command of the king, it was immediately decreed that the pope ſhould march with his cardinals to the church of St Mark, and in the moſt ſolemn manner give thanks to God for ſo great a bleſſing conferred on the ſee of Rome and the Chriſtian world; and that on the Monday after, ſolemn maſs ſhould be celebrated in the church of Minerva; at which the pope, Greg. XIII. and cardinals were preſent; and that a jubilee ſhould be publiſhed throughout the whole Chriſtian world, and the cauſe of it declared to be, to return thanks to God for the extirpation of the enemies of the truth and church in France. In the evening the cannon of St Angelo were fired, to teſtify the public joy; the whole city illuminated with bonfires; and not one ſign of rejoicing omitted that was uſually made for the greateſt victories obtained in favour of the Roman church.

MASSAGETAE, an ancient people about whoſe ſeat there is as much doubt as about that of the Amazons: Tibullus and Ammian place them near Albania, beyond the Araxes, which ſometimes denotes the Oxus; it is probable they dwelt to the eaſt of Sogdiana, (Dionyſius Periegetes, Herodotus, Arrian).

MASSALIANS, a ſet of enthuſiaſts who ſprang up about the year 361, in the reign of the emperor Conſtantius, who maintained that men have two ſouls, a celeſtial and a diabolical, and that the latter is driven out by prayer.

MASSANIELLO, ſee *Hiſtory of* NAPLES.

MASSETER, in anatomy. See there, (*Table of the Muſcles*).

MASSICOT, ſee MASTICOT.

MASSIEU (William), a learned French writer, member of the academy of belles lettres, and of the French academy, was born at Caen in Normandy in 1665, and completed his ſtudies at Paris, when he entered amongſt the Jeſuits; but afterwards left them, that he might follow his inclination to polite literature with the greater freedom. In 1710 he was made Greek profeſſor in the royal college; and enjoyed that poſt till his death, which happened at Paris in 1722. He wrote, 1. Several curious diſſertations in the memoirs of the academy of inſcriptions. 2. A hiſtory of the French poetry, in 12mo, &c.

MASSILIA, (anc. geog.) a town of Gallia Narbonenſis, a colony of Phoceans, from Phocæa, a city of Ionia, and in confederacy with the Romans; univerſally celebrated, not only for its ports, commerce, and ſtrength, but eſpecially for its politeneſs of manners and for its learning. According to Strabo, it was the ſchool for barbarians, who were excited by its means to a fondneſs for Greek literature, ſo that even their public and private tranſactions were all executed in that language. Strabo adds, "At this day the nobleſt Romans repair thither for ſtudy rather than to Athens." Now MARSEILLES, a city and port-town of Provence.

MASSILLON (Jean Baptiſte), ſon of a notary at Hieres in Provence, was born in 1663, and entered into the congregation of the oratory in 1681. He gained the affections of every perſon in the towns to which he was ſent, by the charms of his genius, the livelineſs of his character, and by a fund of the moſt delicate and affecting politeneſs. His firſt attempts in the art of eloquence were made at Vienne, while the was profeſſor of theology. His funeral oration on Henry de Villars, archbiſhop of that city, received univerſal approbation. This ſucceſs induced Father de la Tour, who was at that time general of the congregation, to call him to Paris. After he had been there for ſome time, he was aſked what he thought of the preachers who made a figure on that great theatre?—"I find them poſſeſſed of great genius and abilities (anſwered he); but if I preach, I will not preach like them." He in fact kept his word, and ſtruck out a new path in this great field of eloquence. P. Bourdaloue was excepted from the number of thoſe whom he propoſed not to imitate. If he did not take him for a model in every thing, the reaſon was, that his genius led him to a different ſpecies of eloquence.—His manner of compoſing, therefore, was peculiar to himſelf, and, in the opinion of men of taſte and judgement, was ſuperior to that of Bourdalone. The affecting and natural ſimplicity of the father of the oratory, (ſaid a great man), appear fitter to bring home the truths of Chriſtianity to the heart than all the dialectics of the Jeſuit. We muſt ſeek for the logic of the goſpel in our breaſts; and the moſt powerful reaſonings on the indiſpenſable duty of relieving the diſtreſſed, will make no impreſſion on that man who has beheld without concern the ſufferings of his brother. If logic is neceſſary, it is only in matters of opinion; and theſe are fitter for the preſs than for the pulpit, which ought not to be the theatre of learned diſcuſſions. The truth of theſe reflections was clearly perceived when he appeared at court. Upon preaching his firſt advent ſermon at Verſailles, he received this eulogium from the mouth of Louis XIV. "Father, when I hear others preach, I am very well pleaſed with them; but whenever I hear you, I am diſſatiſfied with myſelf." The firſt time he preached his famous ſermon *on the ſmall number of the elect*, the whole audience were, at a certain place of it, ſeized with a ſudden and violent emotion, and almoſt every perſon half roſe from his ſeat by a kind of involuntary movement. The murmur of acclamation and ſurprize was ſo great, that it threw the orator into confuſion; but this only heightened the impreſſion of that pathetic diſcourſe. What was moſt ſurpriſing in Maſſillon, was his deſcriptions of the world, which were ſo ſublime, ſo delicate, and ſo ſtriking in the reſemblance. When he was aſked whence a man, like him, whoſe life was dedicated to retirement, could borrow them? he anſwered, "From the human heart; however little we examine it, we will find in it the ſeeds of every paſſion. When I compoſe a ſermon (added he), I imagine myſelf conſulted upon ſome doubtful piece of buſineſs, I give my whole application to determine the perſon who has recourſe to me, to act the good and proper part. I exhort him, I urge him, and I leave him not till he has yielded to my perſuaſions." His declamation did not fail to be accompanied with ſucceſs. "We think we ſee him in our pulpits (ſay thoſe who had the pleaſure of hearing him), with the ſimple air, the modeſt carriage, the down-caſt, and humble looks, the eaſy geſture, the affecting tone, and the countenance of a man deeply penetrated with his ſubject, conveying the cleareſt information to the underſtanding, and raiſing the moſt tender emotions in the heart." Baron, the famous comedian, having met him one day in a houſe which was open for the reception of men of letters, paid him this compliment: Continue to deliver as you do. Your manner is peculiar to yourſelf; leave the obſervance of rules to others." When this famous actor came from hearing one of his ſermons, truth drew from him the following confeſſion, which is ſo humiliating to his profeſſion: "Friend (ſaid he to one of his companions who accompanied him), here is an *orator*; we are only *actors*."

In 1704 Maſſillon made his ſecond appearance at court, and diſplayed ſtill more eloquence than before. Louis XIV. after expreſſing his ſatisfaction to him, added, in the moſt gracious tone of voice, *Et je veux, mon pere, vous entendre tous les deux ans.* Theſe flattering encomiums did not leſſen his modeſty. When one of his fellows was congratulating him upon his preaching admirably, according to cuſtom, "Oh! give over, Father (replied he), the devil has told me ſo already, much more eloquently than you." The duties of his office did not prevent him from enjoying ſociety; and in the country he forgot that he was a preacher, but always without treſpaſſing againſt decency. One day when he was at the houſe of M. de Crozat, the latter ſaid to him, "Father, your doctrine terrifies me, but I am encouraged by your life." He was choſen, on account of his philoſophical and conciliatory diſpoſition of mind, to reconcile one cardinal de Noailles with the Jeſuits. All he gained by his attempts was the diſpleaſure of both parties; and he found that it was eaſier to convert ſinners than to reconcile theologians. In 1717, the regent, perſonally acquainted with his merit, appointed him to the biſhopric of Clermont. The next year, being deſtined to preach before Louis XV. who was only nine years of age, he compoſed in ſix weeks thoſe diſcourſes which are ſo well known by the name of *Petit Careme*. Theſe are the chief d'œvre of this orator, and indeed of the oratorical art. They ought continually to be read by preachers as models for the formation of their taſte, and by princes as leſſons of humanity.

Maſſillon was admitted into the French academy a year afterwards, in 1719. The abbacy of Savigny becoming vacant, the cardinal du Bois, to whom he had been weak enough to give an atteſtation for being a prieſt, procured it for him. The funeral oration of the ducheſs of Orleans, in 1723, was the laſt diſcourſe he pronounced in Paris. He never afterwards left his dioceſe, where his gentleneſs, politeneſs, and kindneſs, had gained him the affection of all who knew him. He reduced the exorbitant rights of the epiſcopal roll to moderate ſums. In two years, he cauſed 20,000 livres to be privately conveyed to the Hotel-Dieu of Clermont. His peaceable diſpoſition was never more diſplayed than while he was a biſhop. He took great pleaſure in collecting the fathers of the oratory and the Jeſuits at his country-houſe, and in making them join in ſome diverſion. He died on the 28th of September 1742, at the age of 79. His name has become that of eloquence itſelf. Nobody ever knew better how to touch the paſſions. Preferring ſentiment to every thing elſe, he communicated to the ſoul that lively and ſalutary emotion which excites

cites in us the love of virtue. What pathetic eloquence did his diſcourſes diſplay! what knowledge of the human heart! what conſtant diſcloſing of a mind deeply affected with his ſubject! what ſtrain of truth, philoſophy, and humanity! what imagination, at once the moſt lively, and guided by the ſoundeſt judgment! Juſt and delicate thoughts; ſplendid and lofty ideas; elegant, well choſen, ſublime, and harmonious expreſſions; brilliant and natural images; true and lively colouring; a clear, neat, ſwelling, and copious ſtyle, equally ſuited to the capacity of the multitude, and fitted to pleaſe the man of genius, the philoſopher, and the courtier, from the character of Maſſillon's eloquence, eſpecially in his *Petit Careme*. He could at once think, deſcribe, and feel. It has been juſtly obſerved concerning him, that he was to Bourdaloue what Racine was to Corneille. To give the finiſhing ſtroke to his eulogium, of all the French orators, he is the moſt eſteemed by foreigners.

An excellent edition of Maſſillon's works was publiſhed by his nephew at Paris in 1745 and 1746, in 14 vols. large 12mo, and 12 vols. of a ſmall ſize.—Among them we find, 1. Complete ſets of Sermons for Advent and Lent. It is particularly in his moral diſcourſes, ſuch as are almoſt all thoſe of his ſermons for Advent and Lent, that Maſſillon's genius appears. He excels, ſays M. d'Alembert, in that ſpecies of eloquence, which alone may be preferred to all others, which goes directly to the heart, and which agitates without wounding the ſoul. He ſearches the inmoſt receſſes of the heart, and lays open the ſecret workings of the paſſions, with ſo delicate and tender a hand, that we are hurried along rather than overcome. His diction, which is always eaſy, elegant, and pure, every where partakes of that noble ſimplicity, without which there can be neither good taſte nor true eloquence; and this ſimplicity is, in Maſſillon, joined to the moſt attractive and the ſweeteſt harmony, from which it likewiſe borrows new graces. In ſhort, to complete the charm produced by this enchanting ſtyle, we perceive that theſe beauties are perfectly natural; that they flow eaſily from this ſource, and that they have occaſioned no labour to the compoſer. There even occur ſometimes in the expreſſions, in the turns, or in affecting melody of his ſtyle, inſtances of negligence which may be called happy, becauſe they completely remove every appearance of labour. By thus abandoning himſelf to the natural current of thought and expreſſion, Maſſillon gained as many friends as hearers. He knew, that the more anxious an orator appears to raiſe admiration, he will find thoſe who hear him the leſs diſpoſed to beſtow it. 2. Several Funeral Orations, Diſcourſes, and Panegyrics, which had never been publiſhed. 3. Ten diſcourſes, known by the name of *Petit Careme*. 4. The *Conferences eccleſiaſtiques*, which he delivered in the ſeminary of St Magloire upon his arrival at Paris; thoſe which he delivered to the curates of his dioceſe; and the diſcourſes which he pronounced at the head of the ſynods which he aſſembled every year. 5. Paraphraſes on ſeveral of the Pſalms. The illuſtrious author of theſe excellent tracts wiſhed that they had introduced into France a practice which prevails in England, of reading ſermons inſtead of preaching them from memory; a cuſtom which is very convenient, but by which all the warmth and fervour of eloquence are loſt. He, as well as two others of his brethern, had ſtopt ſhort in the pulpit exactly on the ſame day.—They were all to preach at different hours on Good-Friday, and they went to hear one another in ſucceſſion. The memory of the firſt failed; which ſo terrified the other two, that they experienced the ſame fate. When our illuſtrious orator was aſked, what was his beſt ſermon? he anſwered, "That which I am moſt maſter of." The ſame reply is aſcribed to Bourdaloue. The celebrated P. la Rue was of the opinion of Maſſillon, that getting by heart was a ſlavery which deprived the pulpit of a great many orators, and which was attended with many inconveniences to thoſe who dedicated themſelves to it. The Abbé de la Porte has collected into 1 vol. 12mo the moſt ſtriking ideas, and the moſt ſublime ſtrokes, which occur in the works of the celebrated biſhop of Clermont. This collection, which is made with great judgment, appeared at Paris in 1748, 12mo, and forms the 15th volume of the large edition in 12mo, and the 13th of the ſmall in 12mo. It is entitled, *Penſées ſur differens ſujets de morale et de piete, tirées*, &c.

MASSINGER (Philip), an Engliſh dramatic poet, was born at Saliſbury about the year 1581, and was educated at Oxford. He left the univerſity without taking any degree; and went to London to improve his poetical genius by polite converſation. There he wrote many tragedies and comedies, which were received with vaſt applauſe; and were greatly admired for the economy of the plots and the purity of the ſtyle. He was at the ſame time a perſon of the moſt conſummate modeſty: which rendered him extremely beloved by the poets of his time, particularly by Fletcher, Middleton, Rowley, Field, and Decker, who thought it an honour to write in conjunction with him. He was as remarkable for his abilities as his modeſty. He died ſuddenly at his houſe on the Bank-ſide in Southwark, near the play-houſe; and was interred in St Saviour's church-yard, in the ſame grave with Mr Fletcher the poet.

MASSIVE, among builders, an epithet given to whatever is too heavy and ſolid: thus a maſſive column is one too ſhort and thick for the order whoſe capital it bears; and a maſſive wall is one whoſe openings or lights are too ſmall in proportion.

MASSON (Papirius), a French writer, was the ſon of a rich merchant, and born in the territory of Forez, May 1544. After ſtudying the belles lettres and philoſophy, and travelling to different places, he came to Paris, where he was made librarian to the chancellor of the duke of Anjou, in which place he continued ten years. In 1576, he was made an advocate of parliament; yet never pleaded but one cauſe, which however, he gained with univerſal applauſe.—When the troubles of France were at an end, he married the ſiſter of a counſellor in parliament, with whom he lived thirty-four years, but had no iſſue by her.—The infirmities of age attacked him ſome time before his death, which happened Jan. 9. 1611. He wrote four books of French annals in Latin, firſt printed at Paris 1577, and afterwards in 1598, 4to. The ſecond edition, more enlarged than the firſt, deduces things

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things from Pharamond to Henry II. Maſſon conſidered this as his principal performance; yet he is now chiefly known by his *Elogia virorum clariſſimorum,* although he publiſhed ſeveral other works.

Masson (John), a reformed miniſter in Holland ſome years ago. He was originally of France, but fled into England to enjoy that liberty in religion which his country refuſed him. He wrote 1. *Hiſtoire critique de la republique des lettres,* from 1712 to 1717, in 15 vols. 12mo. 2. *Vitæ Horatii Ovidii et Plinii junioris,*" 3 vols ſmall 8vo, and printed abroad, though dedicated to Engliſhmen of rank: then at Leyden, 1708, to Lord Harvey: the ſecond at Amſterdam, 1708, to Sir Juſtinian Iſham; the third at Amſterdam, 1709, to the biſhop of Worceſter. Theſe lives are drawn up in a chronological order, very learnedly and very critically; and ſerve to illuſtrate the hiſtory not only of the particular perſons, but of the times alſo in which they live. 3. *Hiſtoire de Pierre Bayle & de ſes ouvrages;* Amſterdam, 1716, in 12mo. This at leaſt is ſuppoſed to be his, though at firſt it was given to M. la Monnoye.

Masson (Anthony), an eminent French engraver, who flouriſhed towards the concluſion of the laſt century, and reſided chiefly at Paris. It appears that he ſometimes amuſed himſelf with painting portraits from the life, ſome of which he alſo engraved. We have no account of the life of this extraordinary artiſt; nor are we even informed from what maſter he learned the principles of engraving. He worked entirely with the graver, and handled that inſtrument with aſtoniſhing facility. He ſeems to have had no kind of rule to direct him with reſpect to the turning of the ſtrokes; but twiſted and tirled them about, without the leaſt regard to the different forms he intended to expreſs, making them entirely ſubſervient to his own caprice. Yet the effect he has produced in this ſingular manner (Mr Strutt obſerves), is not only far ſuperior to what one could have ſuppoſed, but is often very pictureſque and beautiful. It was not in hiſtorical engraving that his greateſt ſtrength conſiſted. He could not draw the naked parts of the human figure ſo correctly as was neceſſary; but where the ſubject required the figures to be clothed, he ſucceeded in a wonderful manner. Among the moſt eſteemed works by this admirable artiſt may be reckoned the following: The aſſumption of the Virgin, a large upright plate from Rubens; a holy family, a middling-ſized plate, lengthwiſe, from N. Mignard; Chriſt with the pilgrams at Emaus, a large plate, lengthwiſe, from Titian, the original picture of which is in the cabinet of the king of France. This admirable print is commonly known by the name of *the table-cloth;* for the cloth, with which the table is covered, is executed in a very ſingular ſtyle. Alſo the following portraits, among others: The comte de Harcourt, a large upright plate, reckoned a maſterpiece in this claſs of ſubjects; Guillaume or Briſacier, ſecretary to the queen of France; a middling-ſized upright plate: uſually known in England by the name of *the Grey-headed Man,* becauſe the hair in this print is ſo finely executed.

Maſſuah.

MASSUAH, a ſmall iſland in the Red Sea, near the coaſt of Abyſſinia, about three quarters of a mile long, and half as broad, one-third of which is occupied by houſes, another by ciſterns for receiving rain water, and one reſerved for a burial place. It has an excellent harbour, with water ſufficiently deep for ſhips of any ſize to the very edge of the iſland; and ſo well ſecured, that they may ride in ſafety, let the wind blow from what quarter or with what degree of ſtrength it will. By the ancients it was called *Sebaſticum Os,* and was formerly a place of great conſequence on account of its harbour, from whence a very extenſive commerce was carried on, and poſſeſſed a ſhare of the Indian trade in common with other ports of the Red Sea near the Indian Ocean.—A very conſiderable quantity of valuable goods was alſo brought thither from the tract of mountainous country behind it, which in all ages has been accounted very unhoſpitable, and almoſt inacceſſible to ſtrangers. The principal articles of exportation were gold, ivory elephants, and buffaloes hides; but above all, ſlaves, who, on account of their perſonal qualifications, were more eſteemed than thoſe from any other quarter.—Pearls of a conſiderable ſize, and of a fine water, are likewiſe found along the coaſt; from the abundance of all which valuable commodities, the great defect, a want of water, was forgot, and the inhabitants cheerfully ſubmitted to ſuch a great inconvenience. The iſland of Maſſuah fell under the power of the Turks in the time of the emperor Selim, ſoon after the conqueſt of Arabia Felix by Sinan Buſha, and was for ſome time governed by an officer from Conſtantinople. From thence the conqueſt of Abyſſinia was for ſome time attempted, but always without ſucceſs. Hence it began to loſe its value as a garriſon for troops, as it had done in the commercial way after the diſcovery the paſſage to India by the Cape of Good Hope.—Being thus deprived of its importance in every reſpect, the Turks no longer thought it worth while to ſend a baſhaw thither as formerly, but conferred the government upon the chief of a tribe of Mahometans named *Belowie,* who inhabit the coaſts of the Red Sea under mountains of Habab, in the latitude of about 14° north. On this officer they conferred the title of *Naybe;* and on the removal of the baſhaw, he remained in fact maſter of the place, though, to ſave appearances, he pretended to hold it from the Ottoman Porte, by a firman from the Grand Signior for that purpoſe, and the payment of an annual tribute.

The Turks had originally put into the town of Maſſuah a garriſon of Janizaries; who, being left there on the withdrawing of the baſhaw, and intermarrying with the natives, ſoon became entirely ſubjected to the Naybe's influence. The latter finding himſelf at a great diſtance from his protectors, the Turks, whoſe garriſons were every where falling into decay, and that in conſequence of this he was entirely in the power of the emperor of Abyſſinia, began to think of taking ſome method of ſecuring himſelf on that ſide Accordingly it was agreed that one half of the cuſtoms ſhould be paid to the Abyſſinian monarch; who in return was to allow him to enjoy his government unmoleſted. Having thus ſecured the friendſhip of the emperor of Abyſſinia, the Naybe began gradually to withdraw the tribute he had been accuſtomed to pay to the baſhaw of Jidda, to whoſe goverment Maſſuah had been aſſigned; and at laſt to pay as little regard to the government of Abyſſinia; and in this ſtate of in-

independence he was when Mr Bruce arrived there in 1769 on his way to Abyſſinia. This gentleman found both the prince and his people extremely unhoſpitable and treacherous; ſo that he underwent a variety of dangers during his reſidence there, nor was it without great difficulty that he could get away from thence at laſt.

The iſland of Maſſuah, as we have ſaid, is entirely deſtitute of water; nor can it be ſupplied with proviſions of any kind but from the mountainous country of Abyſſinia on the continent. Arkeeko, a large town in the bottom of the bay, has water, but is in the ſame predicament with regard to proviſions; for the adjacent tract of flat land, named *Samhar*, is a perfect deſart, inhabited only from the month of November to April by ſome wandering tribes, who carry all their cattle to the Abyſſinian ſide of the mountains when the rains fall there. Being thus in the territories of the Abyſſinians, it is in the power of the emperor of that country, or of his officer the Baharnagaſh, to ſtarve Maſſuah and Arkeeko by prohibiting the paſſage of any proviſions from the Abyſſinian ſide of the mountains.

The houſes of Maſſuah are generally conſtructed of long poles and bent graſs, as is uſual with other towns of Arabia; only about 20 are of ſtone, and ſix or eight of thoſe two ſtories high. The ſtones with which they are built have been drawn out of the ſea: and in them the bed of that curious muſcle found embodied in the ſolid rock at Mahon is frequently to be ſeen. Theſe are called *datt oli da mare*, or ſea dates: but our author never ſaw any of the fiſh themſelves, though he has no doubt that they may be met with in the rocky iſlands of Maſſuah if they would take the trouble of break the rocks for them. All the neceſſaries of life are very dear in this place; and their quality is alſo very indifferent, owing to the diſtance from whence they muſt be brought, and the danger of carrying them through the deſart of Samhar, as well as to the extortions of the Naybe himſelf, who under the name of *cuſtoms*, takes whatever part of the goods he thinks proper; ſo the profit left to the merchant is ſometimes little or nothing. All the money here is valued by the Venetian ſequin; and it is owing to commercial intercourſe with the Arabian coaſt that any money at all is to be met with on the iſland or the eaſtern coaſt of Africa. Glaſs beads of all kinds and colours, whether whole or broken, paſs for ſmall money.

Though Maſſuah has now loſt very much of its commercial imporance, a conſiderable trade is ſtill carried on from the place. From the Arabian ſide are imported blue cotton and other cloths; ſome of them from India being very fine. Other articles are Venetian beads, cryſtal, looking and drinking glaſſes, with cohol or crude antimony. Theſe three laſt articles come in great quantity from Cairo, firſt in the coffee-ſhips to Jidda, and then in ſmall barks to the port of Maſſuah. Old copper is alſo a valuable article of commerce. The Golla and all the various tribes to the weſtward of Gondar wear bracelets of this metal, which in ſome parts of that barbarous country is ſaid to ſell for its weight of gold. Here is alſo a ſhell, an univalve of the ſpecies of volutes, which ſells at an high price, and paſſes for money among the various tribes of Galla, The Banians were once the principal merchants of Maſſuah; but their number is now reduced to ſix, who are ſilver-ſmiths, and ſubſiſts by making ornaments for the women on the continent. They likewiſe eſſay gold, but make a poor livelihood.

MASSUET (Rene, or Renatus), a very learned Benedictine of the congregation of St Maur, was born at S. Owen de Marcelles, in 1665. He is chiefly known for the new edition of St Irenæus, which he publiſhed in 1710. He conſulted ſeveral manuſcripts which had never been examined, for that purpoſe, and made new notes and learned prefaces. He died in 1716, after having written and publiſhed ſeveral other works.

MAST, a long round piece of timber, elevated perpendicularly upon the keel of a ſhip, to which are attached the yards, the ſails, and the rigging. A maſt, with regard to its length, is either formed of one ſingle piece, which is called a *pole-maſt*, or compoſed of ſeveral pieces joined together, each of which retains the name of maſt ſeparately. The loweſt of theſe is accordingly named the *lower-maſt. a*, fig. 1. the next in height is the top-maſt, *b*, which is erected at the head of the former; and the higheſt is the top gallant maſt, *c*, which is prolonged from the upper end of the top-maſt. Thus the two laſt are no other than a continuation of the firſt upwards.

The lower-maſt is fixed in the ſhip by an apparatus deſcribed in the articles Hulk and Sheers: the foot or heel of it, reſts in a block of timber called the *ſtep*, which is fixed upon the *kelſon*: and the top-maſt is attached to the head of it by the *cap* and *the treſtle-trees*. The latter of theſe are two ſtrong bars of timber, ſupported by two prominences which are as ſhoulders on the oppoſite ſides of the maſt, a little under its upper end: athwart theſe bars are fixed the *croſs trees*, upon which the frame of the top is ſupported. Between the lower-maſt-head and the foremoſt of the croſs-trees, a ſquare ſpace remains vacant, the ſides of which are bounded by the two treſtle-trees. Perpendicularly above this is the foremoſt hole in the cap, whoſe after hole is ſolidly fixed on the head of the lower-maſt. The top-maſt is erected by a tackle, whoſe effort is communicated from the head of the lower-maſt to the foot of the top-maſt; and the upper end of the latter is accordingly guided into and conveyed up through the holes between the treſtle-ttees and the cap, as abovementioned. The machinery, by which it is elevated, or, according to the ſea-phraſe, *ſwayed up*, is fixed in the following manner: the top rope *d*, fig. 3. paſſing through a block *e*, which is hooked on one ſide of the cap, and afterwards through a hole, furniſhed with a ſheave or pulley *f*, on the lower end of the top-maſt, is again brought upwards on the other ſide of the maſt, where it is at length faſtened to an eye bolt in the cap *g*, which is always on the ſide oppoſite to the top-block *e*. To the lower end of the top rope is fixed the top-tackle *h*, the effort of which being tranſmitted to the top-rope *d*, and thence to the heel of the top-maſt *f*, neceſſarily lifts the latter upwards, parallel to the lower-maſt. When the top-maſt is raiſed to its proper height, fig. 4. the lower end of it becomes firmly wedged in the ſquare hole above deſcribed, between the treſtle-trees. A bar of wood or iron called the *fid*, is then thruſt through a hole *i* in the heel of it,

Plate CCLXXI.

it, acroſs the treſtle-trees, by which the whole weight of the top-maſt is ſupported.

In the ſame manner as the top-maſt is retained at the head of the lower-maſt, the top-gallant-maſt is erected, and fixed at the head of the top-maſt.

Plate CCLXXXI.

Beſides the parts already mentioned in the conſtruction of maſts, with reſpect to their length, the lower-maſts of the largeſt ſhips are compoſed of ſeveral pieces united into one body. As theſe are generally the moſt ſubſtantial parts of various trees, a maſt, formed by this aſſemblage, is juſtly eſteemed much ſtronger than one conſiſting of any ſingle trunk, whoſe internal ſolidity may be very uncertain. The ſeveral pieces are formed and joined together, as repreſented in the ſection of a lower-maſt of this ſort, fig. 5. where *a* is the ſhaft, or principal piece into which the reſt are fixed, with their ſides or faces cloſe to each other. The whole is ſecured by ſeveral ſtrong hoops of iron, driven on the outſide of the maſt, where they remain at proper diſtances.

The principal articles to be conſidered in equipping a ſhip with maſts are, 1ſt, the number; 2d, their ſituation in the veſſel; and, 3d, their height above the water.

The maſts being uſed to extend the ſails by means of their yards, it is evident, that if their number were multiplied beyond what is neceſſary, the yards muſt be extremely ſhort, that they may not entangle each other in working the ſhip, and by conſequence their ſails will be very narrow, and receive a ſmall portion of wind. If, on the contrary, there is not a ſufficient number of maſts in the veſſel, the yards will be too large and heavy, ſo as not to be managed without difficulty. There is a mean between theſe extremes, which experience and the general practice of the ſea have determined; by which it appears, that in large ſhips every advantage of ſailing is retained by three maſts and a bowſprit.

The moſt advantageous poſition of the maſts is undoubtedly that from whence there reſults an equilibrium between the reſiſtance of the water on the body of the ſhip on one part, and of the direction of their effort on the other. By every other poſition this equilibrium is deſtroyed, and the greateſt effort of the maſts will operate to turn the ſhip horizontally about its direction; a circumſtance which retards her velocity. It is counterbalanced indeed by the helm; but the ſame inconvenience ſtill continues; for the force of the wind, having the reſiſtance of the helm to overcome, is not entirely employed to puſh the veſſel forward. The axis of the reſiſtance of the water ſhould then be previouſly determined, to diſcover the place of the *main-maſt*, in order to ſuſpend the efforts of the water equally, and place the other maſts ſo as that their particular direction will coincide with that of the main-maſt. The whole of this would be capable of a ſolution if the figure of the veſſel were regular, becauſe the point, about which the reſiſtance of the water would be in equilibrio, might be diſcovered by calculation.

But when the real figure of the ſhip is conſidered, theſe flattering ideas will inſtantly vaniſh. This obſervation induced M. Saverien to employ a mechanical method to diſcover the axis of reſiſtance of the water, which he apprehended might be uſed with ſucceſs in the manner following:

Plate CCLXXXI.

When the veſſel is launched, before the places of the maſts are determined, extend a rope AB, fig. 6. from the head to the ſtern. To the extremities A and B attach two other ropes, AD, BC, and apply to the other ends of theſe ropes two mechanical powers, to draw the ſhip according to the direction BC, parallel to itſelf. The whole being thus diſpoſed, let a moveable tube Z, fixed upon the rope AB, have another rope ZR attached to it, whoſe other end communicates with a mechanical power R, equal to the two powers D and C. This laſt being applied to the ſame veſſel, in ſuch a manner as to take off the effects of the two others by ſliding upon the rope AB, ſo as to diſcover ſome point Z, by the paralleliſm of the ropes AD, BC feebly extended with the rope ZR; the line ZR will be the axis of the equilibrium of the water's reſiſtance, and by conſequence the main-maſt ſhould be planted in the point Z.

The figures E, E, E, are three windlaſſes on the ſhore, by which this experiment is applied.

With regard to the ſituation of the other maſts, it is neceſſary, in the ſame manner, to diſcover two points; ſo that the direction of the two mechanical powers operating, will be parallel to the axis of reſiſtance RZ already found.

The exact height of the maſts, in proportion to the form and ſize of the ſhip, remains yet a problem to be determined. The more the maſts are elevated above the centre of gravity, the greater will be the ſurface of ſail which they are enabled to preſent to the wind; ſo far an additional height ſeems to have been advantageous. But this advantage is diminiſhed by the circular movement of the maſt, which operates to make the veſſel ſtoop to its effort; and this inclination is increaſed in proportion to the additional height of the maſt, an inconvenience which it is neceſſary to guard againſt. Thus what is gained upon one hand is loſt upon the other. To reconcile theſe differences, it is certain, that the height of the maſt ought to be determined by the inclination of the veſſel, and that the point of her greateſt inclination ſhould be the term of this height above the centre of gravity. See the article Trim.

With regard to the general practice of determining the height of the maſts, according to the different rates of the ſhips in the royal navy, the reader is referred to the article Sail.

In order to ſecure the maſts, and counterbalance the ſtrain they receive from the effort of the ſails impreſſed by the wind, and the agitation of the ſhip at ſea, they are ſuſtained by ſeveral ſtrong ropes, extended from their upper ends to the outſide of the veſſel, called *ſhrouds*, as repreſented in fig. 4. They are further ſupported by other ropes, ſtretched from their heads towards the fore-part of the veſſel.

The maſt, which is placed at the middle of the ſhip's length, is called the *main-maſt*; that which is placed in the forepart, the *fore-maſt*; and that which is towards the ſtern, is termed the *mizen-maſt*.

N. B. *Mizen* is applied to this maſt by all the nations of Europe, except the French, who alone call the fore-maſt *miſaine*.

MASTER, a title given to ſeveral officers and perſons of authority and command; particularly to the chiefs of the orders of knighthood, &c.—Thus we ſay the grand-maſter of Malta; of St Lazarus; of the golden fleece; of the free maſons, &c.

Master (*magiſter*), was a title frequent among the Romans: they had their maſter of the people, *magiſter populi*, who was the dictator. Maſter of the cavalry, *magiſter equitum*, who held the ſecond poſt in an army after the dictator. Under the later emperors there were alſo maſters of the infantry, *magiſtri peditum*. A maſter of the cenſus, *magiſter cenſus*, who had nothing of the charge of a cenſor, or ſubcenſor, as the name ſeems to intimate; but was the ſame with the *præpoſitus frementariorum*.

Master of the Militia (*magiſter militiæ*), was an officer in the lower empire, created, as it is ſaid, by Diocleſian, who had the inſpection and government of all the forces, with power to puniſh, &c. ſomewhat like a conſtable of France. At firſt there were two of theſe officers inſtituted, the one for the infantry, and the other for the cavalry; but the two were united into one under Conſtantine. Afterwards, as their power was increaſed, ſo was their number alſo; and there was one appointed for the court, another for Thrace, another for the Eaſt, and another for Illyria. They were afterwards called *comites counts*, and *clariſſimi*. Their power was only a branch of that of the *præfectus prætorii*, who by that means became a civil officer.

Master of Arms (*magiſter armorum*), was an officer or comptroller under the maſter of the militia.

Master of the Offices (*magiſter officiorum*), had the ſuperintendance of all the officers of the court: he was alſo called *magiſter officii palatini*; ſimply *magiſter*; and his poſt *magiſteria*.—This officer was the ſame in the weſtern empire with the curopalates in the eaſtern.

Master at Arms, in Britain, is an officer appointed to teach the officers and crew of a ſhip of war the exerciſe of ſmall arms; to confine and plant centinels over the priſoners, and ſuperintend whatever relates to them during their confinement. He is alſo to obſerve that the fire and lights are all extinguiſhed as ſoon as the evening-gun is fired, except thoſe which are permitted by proper authority, or under the inſpection of centinels. It is likewiſe his duty to attend the gangway when any boats arrive aboard, and ſearch them carefully, together with their rowers, that no ſpirituous liquors may be conveyed into the ſhip unleſs by permiſſion of the commanding officer. In theſe ſeveral duties he is aſſiſted by proper attendants, called his *corporals*, who alſo relieve the centinels and one another at certain periods.

Master of Arts, the firſt degree taken up in foreign univerſities, but the ſecond in ours; candidates not being admitted to it till they have ſtudied in the univerſity ſeven years.

Master-Attendant, is an officer in royal dock-yards, appointed to haſten and aſſiſt at the fitting out or diſmantling, removing, or ſecuring veſſels of war, &c. at the port where he reſides. He is particularly to obſerve, that the king's ſhips are ſecurely moored, and for this purpoſe he is expected frequently to review the moorings which are ſunk in the harbour, and obſerve that they are kept in proper repair. It is alſo his duty to viſit all the ſhips in ordinary, and ſee that they are frequently cleaned and kept in order; and to attend at the general muſters in the dock-yards, taking care that all the officers, artificers, and labourers, regiſtered at the navy books, are preſent at their duty.

Master of the Ceremonies, is an officer inſtituted by King James I. for the more ſolemn and honourable reception of ambaſſadors, and ſtrangers of quality, whom he introduces into the preſence.—The badge of this office is a gold chain and medal, having on one ſide an emblem of peace, with King James's motto; and on the reverſe the emblem of war, with *Dieu & mon droit*. He is always ſuppoſed to be a perſon of good addreſs, and a maſter of languages, and has an appointment of 300 l. a year: he is conſtantly attending at court, and hath under him an aſſiſtant maſter, or deputy, at 6s. 8d. a day, who holds his place during the king's pleaſure.

There is alſo a third officer, called *marſhal of the ceremonies*, with 100l. a-year, whoſe buſineſs is to receive and diſtribute the maſter's orders, or the deputy's, for the ſervice; but without their order he can do nothing. This is the king's gift.

Masters of Chancery are uſually choſen out of the barriſters of the common law; and ſit in chancery, or at the rolls, as aſſiſtants to the lord chancellor and the maſter of the rolls. All theſe, ſo late as the reign of Queen Elizabeth, were commonly doctors of the civil law.—To them are alſo committed interlocutory reports, examination of bills in chancery, ſtating of accounts, taxing coſts, &c. and ſometimes, by way of reference, they are impowered to make a final determination of cauſes.

They have time out of mind had the honour to ſit in the lords houſe, though they have neither writs nor patent to impower them; but they are received as aſſiſtants to the lord chancellor and maſter of the rolls. They had anciently the care of inſpecting all writs of ſummons, which is now performed by the clerk of the petty-bag. When any meſſage is ſent from the lords to the commons, it is carried by the maſters of chancery. Before them alſo affidavits are made, and deeds and recognizances acknowledged.

Beſides theſe, who may be called *maſters of chancery ordinary* (being 12 in number, whereof the maſter of the rolls is reputed the chief), there are alſo maſters of chancery extraordinary, appointed to act in the ſeveral counties of England beyond 10 miles diſtance from London, by taking affidavits, recognizances, &c. for the eaſe of the ſuitors of the court.

Master of the Faculties, an officer under the archbiſhop of Canterbury, who grants licences and diſpenſations; he is mentioned in the ſtatute 22 and 23 Car. II. See *Court of Faculties*.

Master-Gunner. See Gunner.

Master of the Horſe is reckoned the third great officer of the court, and is an office of great honour and antiquity, and always (when not put in commiſſion) filled by noblemen of the higheſt rank and abilities. He has the management and diſpoſal of all the king's ſtables and bred horſes. He has authority over the equerries and pages, coachmen, footmen, grooms, riders of the great horſe, farriers, and ſmiths. He appoints all the other tradeſmen who work for the king's ſtables; and by his warrant to the avenor, makes them give an oath to be true and faithful. In ſhort, he is en-

Fig. 2

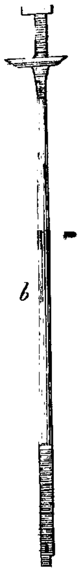


Fig. 3

Fig. 6.

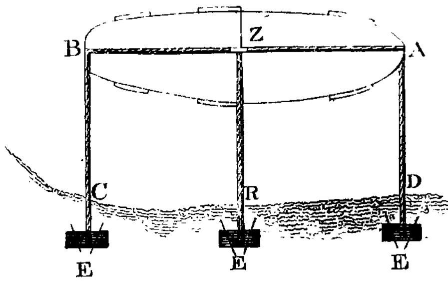


Fig. 5.

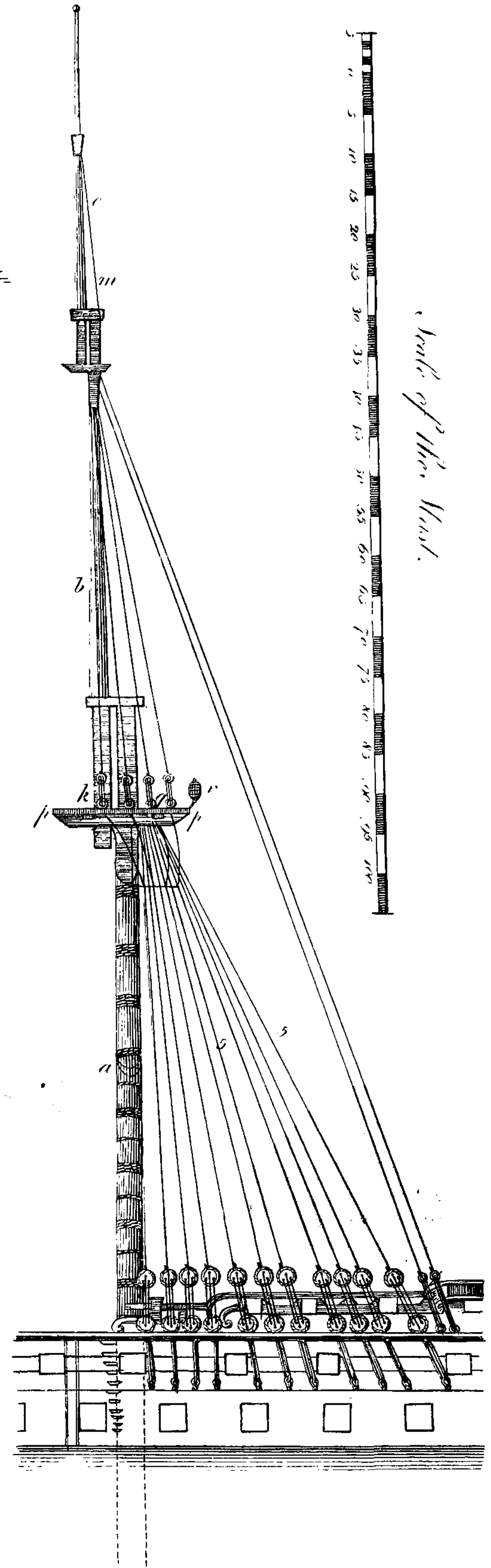


Fig. 4.

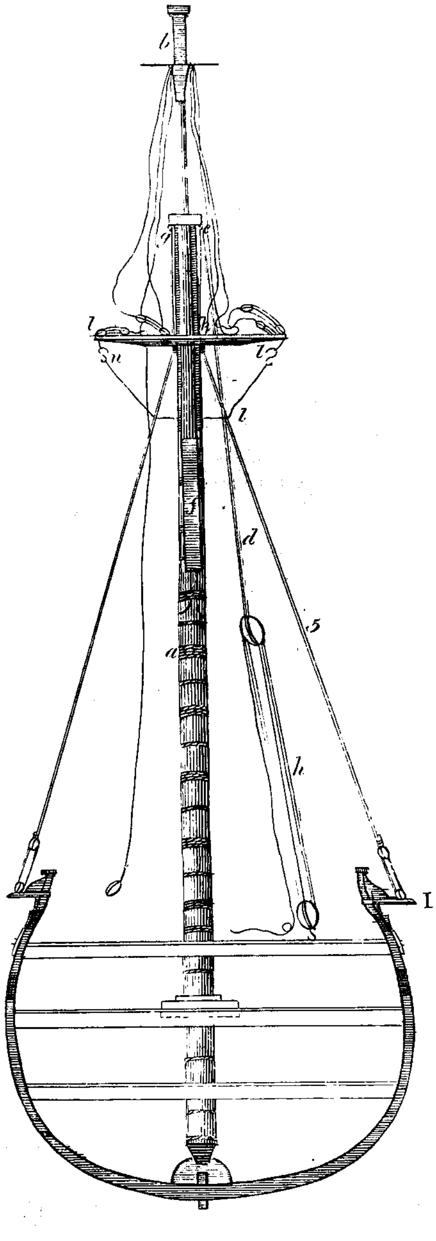
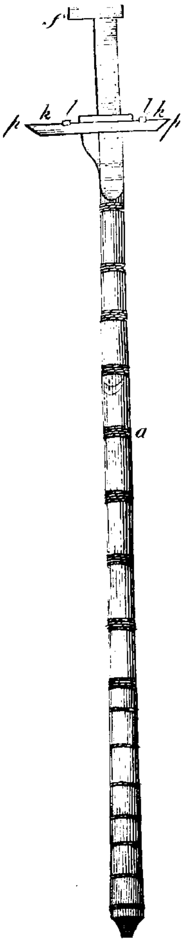


Fig. 1.



Scot Philad.ª

entruſted with all the lands and revenues appropriated for the king's breed of horſes, the expences of the ſtable, and of the coaches, litters, &c. He alone has the privilege of making uſe of any of the king's horſes, pages, footmen, &c.; and at any ſolemn cavalcade he rides next the king, and leads a horſe of ſtate. His ſalary is L. 1276 : 13 : 4 *per annum*. There is alſo a maſter of the horſe in the eſtabliſhment of her majeſty's houſehold, with a ſalary of 800l. a-year.

Master of the houſehold, is an officer under the treaſurer of the houſehold, in the king's gift: his buſineſs is to ſurvey the accounts of the houſehold.—He has L. 66, 13: 4 a-year wages, and L. 433: 6; 8 board-wages.

Master of the mint, was anciently the title of him who is now called *warden of the mint*; whoſe office is to receive the ſilver and bullion which comes to the mint to be coined, and to take care thereof. The office of maſter and worker is now diſtinct: and this officer is allowed for himſelf and three clerks 650l. a-year.

Master of the Ordnance. See Ordnance.

Master of the Revels, an officer with an appointment of 100l. a year, whoſe buſineſs is to order all things relating to the performance of plays, maſques, balls, &c. at court. Formerly he had alſo a juriſdiction of granting licences to all who travel to act plays, puppet-ſhows, or the like diverſions; neither could any new play be acted at either of the two houſes till it had paſſed his peruſal and licence; but theſe powers were afterwards much abridged, not to ſay annihilated, by a ſtatute for regulating playhouſes, till the licenſing plays by the lord chamberlain was eſtabliſhed. This officer has a yeoman with L.46 : 11 : 8 a-year.

Master of the Rolls, a patent-officer for life: who has the cuſtody of the rolls and patents which paſs the great ſeal, and of the records of the chancery.

In the abſence of the lord chancellor or keeper, he alſo ſits as judge in the court of chancery; and is by Sir Edward Coke called his *aſſiſtant*.

At other times he hears cauſes in the rolls-chapel, and makes orders and decrees. He is alſo the firſt of the maſters of chancery, and has their aſſiſtance at the rolls: but all hearings before him are appealable to the lord chancellor.

He has alſo his writ of ſummons to parliament, and ſits next to the lord chief juſtice of England on the ſecond woolpack. He has the keeping of the parliament-rolls, and has the rolls-houſe for his habitation; as alſo the cuſtody of all charters, patents, commiſſions, deeds, and recognizances, which being made of rolls of parchment gave riſe to the name. Anciently he was called *clerk of the rolls*.

Concerning the authority of the maſter of the rolls to hear and determine cauſes, and his general power in the court of chancery, there were (not many years ſince) divers queſtions and diſputes very warmly agitated; to quiet which it was declared by ſtat. 3. Geo. II. cap. 30. that all orders and decrees by him made, except ſuch as by the courſe of the court were appropriated to the great ſeal alone, ſhould be deemed to be valid; ſubject nevertheleſs to be diſcharged or altered by the lord chancellor, and ſo as they ſhall not be inrolled till till the ſame are ſigned by his lordſhip.

In his gift are the ſix clerks in chancery, the examiners, three clerks of the petty-bag, and the ſix clerks of the rolls-chapel where the rolls are kept. See Rolls, Clerk, &c,

The maſter of the rolls is always of the privy council; and his office is of great profit, though much ſhort of what it has been.

Master of a ſhip, an officer to whom is committed the direction of a merchant-veſſel, who commands it in chief, and is charged with the merchandiſes aboard.

In the Mediterranean the maſter is frequently called *patron*, and in long voyages *captain*.

It is the proprietor of the veſſel that appoints the maſter; and it is the maſter who provides the equipage, hires the pilots, ſailors, &c. The maſter is obliged to keep a regiſter of the ſeamen and officers, the terms of their contract, the receipts and payments, and, in general, of every thing relating to his commiſſion.

Master of a ſhip of War, is an officer appointed by the commiſſioners of the navy, to take charge of navigating a ſhip from port to port under the direction of the captain. The management and diſpoſition of the ſails, the working of a ſhip into her ſtation in the order of battle, and the direction of her movements in the time of action, and in other circumſtances of danger, are alſo more particularly under his inſpection. It is likewiſe his duty to examine the proviſions, and accordingly to admit none into the ſhip but ſuch as are ſound, ſweet, and wholeſome. He is moreover charged with the ſtowage; and for the performance of theſe ſervices he is allowed ſeveral aſſiſtants who are properly termed *mates* and *quarter-maſters*.

Master of the Temple. The founder of the order of the templars, and all his ſucceſſors were called *magni templi magiſtri*; and ever ſince the diſſolution of the order, the ſpiritual guide and director of the houſe is called by that name. See Temple and Templar.

There were alſo ſeveral other officers under this denomination, as maſter of the wardrobe, with a ſalary of 1000l. a-year; maſter of the harriers, with 2000l. a-year, maſter of the ſtaghounds, with 800l. a-year maſter of the jewel-office, &c. all now aboliſhed.

Master and Servant, in England; a relation founded in convenience, whereby a man is directed to call in the aſſiſtance of others, where his own ſkill and labour will not be ſufficient to anſwer the cares incumbent upon him. For the ſeveral ſorts of ſervants, and how that character is created or deſtroyed, ſee the article Servant. In the preſent article we ſhall conſider, firſt, the effect of this relation with regard to the parties themſelves; and ſecondly, its effects with regard to others.

1. The manner in which this relation affects either the maſter or ſervant. And, firſt, by hiring and ſervice for a year, or apprenticeſhip under indentures, a perſon gains a ſettlement in that pariſh wherein he laſt ſerved 40 days. In the next place, perſons ſerving ſeven years as apprentices to any trade have an excluſive right to exerciſe that trade in any parts of England. This law, with regard to the excluſive part of

it, has by turns been looked upon as a hard law, or as a beneficial one, according to the prevailing humour of the times; which has occaſioned a great variety of reſolutions in the courts of law concerning it; and attempts have been frequently made for its repeal, tho' hitherto without ſucceſs. At common law every man might uſe what trade he pleaſed; but this ſtatute reſtrains that liberty to ſuch as have ſerved as apprentices; the adverſaries to which proviſion ſay, that all reſtrictions (which tend to introduce monopolies) are pernicious to trade; the advocates for it allege, that unſkilfulneſs in trades is equally detrimental to the public as monopolies. This reaſon indeed only extends to ſuch trades, in the exerciſe whereof ſkill is required; but another of their arguments goes much farther; viz. their apprenticeſhips are uſeful to the commonwealth, by employing of youth, and learning them to be early induſtrious; but that no one would be induced to undergo a ſeven years ſervitude, if others, tho' equally ſkilful, were allowed the ſame advantages without having undergone the ſame diſcipline; and in this there ſeems to be much reaſon. However, the reſolutions of the courts have in general rather confined than extended the reſtriction. No trades are held to be within the ſtatute, but ſuch as were in being at the making of it; for trading in a country village, apprenticeſhips are not requiſite, and following the trade ſeven years is ſufficient without any binding; for the ſtatute only ſays, the perſon muſt ſerve *as* an apprentice, and does not require an actual apprenticeſhip to have exiſted.

A maſter may by law correct his apprentice for negligence or other miſbehaviour, ſo it be done with moderation; though, if the maſter or maſter's wife beats any other ſervant of full age, it is good cauſe of departure. But if any ſervant, workman, or labourer, aſſaults his maſter or dame, he ſhall ſuffer one year's impriſonment, and other open corporal puniſhment, not extending to life or limb.

By ſervice all ſervants and labourers, except apprentices, become intitled to their wages; according to agreement, if menial ſervants; or according to the appointment of the ſheriff or ſeſſions, if labourers or ſervants in huſbandry: for the ſtatutes for regulation of wages extend to ſuch ſervants only: it being impoſſible for any magiſtrate to be a judge of the employment of menial ſervants, or of courſe to aſſeſs their wages.

2. Let us now ſee how ſtrangers may be affected by this relation of maſter and ſervant; or how a maſter may behave towards others on behalf of his ſervant, and what a ſervant may do on behalf of his maſter.

And, firſt, the maſter may *maintain*, that is, abet and aſſiſt, his ſervant in any action at law againſt a ſtranger: whereas, in general, it is an offence againſt public juſtice to encourage ſuits and animoſities, by helping to bear the expence of them, and is called in law *maintenance*. A maſter alſo may bring an action againſt any man for beating or maiming his ſervant but in ſuch caſe he muſt aſſign, as a ſpecial reaſon for ſo doing, his own damage by the loſs of his ſervice; and this loſs muſt be proved upon the trial. A maſter likewiſe may juſtify an aſſault in defence of his ſervant and a ſervant in defence of his maſter: the maſter, becauſe he has an intereſt in his ſervant, not to be deprived of his ſervice; the ſervant, becauſe it is part of his duty, for which he receives his wages, to ſtand by and defend his maſter. Alſo if any perſon do hire or retain my ſervants, being in my ſervice, for which the ſervant departeth from me and goeth to ſerve the other, I may have an action for damages againſt both the new maſter and the ſervant, or either of them: but if the new maſter did not know that he is my ſervant, no action lies: unleſs he afterwards refuſe to reſtore him upon information and demand. The reaſon and foundation upon which all this doctrine is built, ſeems to be the property that every man has in the ſervice of his domeſtics; acquired by the contract of hiring, and purchaſed by giving them wages.

As for thoſe things which a ſervant may do on behalf of his maſter, they ſeem all to proceed upon this principle, that the maſter is anſwerable for the act of his ſervant, if done by his command, either expreſsly given or implied: *nam qui facit per alium, facit per ſe.* Therefore, if the ſervant commit a treſpaſs by the command or encouragement of his maſter, the maſter ſhall be guilty of it: not that the ſervant is excuſed, for he is only to obey his maſter in matters that are honeſt and lawful. If an innkeeper's ſervants rob his gueſts, the maſter is bound to reſtitution; for as there is a confidence repoſed in him, that he will take care to provide honeſt ſervants, his negligence is a kind of implied conſent to the robbery; *nam, qui non prohibet, cum prohibere poſſit, jubet.* So likewiſe if the drawer at a tavern ſells a man bad wine, whereby his health is injured, he may bring an action againſt the maſter; for although the maſter did not expreſsly order the ſervant to ſell it to that perſon in particular, yet his permitting him to draw and ſell it at all is impliedly a general command.

In the ſame manner, whatever a ſervant is permitted to do in the uſual courſe of his buſineſs, is equivalent to a general command. If I pay money to a banker's ſervant, the banker is anſwerable for it: if I pay it to a clergyman's or a phyſician's ſervant, whoſe uſual buſineſs it is not to receive money for his maſter, and he imbezzles it, I muſt pay it over again. If a ſteward lets a leaſe of a farm, without the owner's knowledge, the owner muſt ſtand to the bargain; for this is the ſteward's buſineſs. A wife, a friend, a relation, that uſe to tranſact buſineſs for a man, are *quoad hoc* his ſervants; and the principal muſt anſwer for their conduct: for the law implies, that they act under a general command; and without ſuch a doctrine as this no mutual intercourſe between man and man could ſubſiſt with any tolerable convenience. If I uſually deal with a tradeſman by myſelf, or conſtantly pay him ready money, I am not anſwerable for what my ſervant takes up upon truſt; for here is no implied order to the tradeſman to truſt my ſervant: but if I uſually ſend him upon truſt, or ſometimes on truſt and ſometimes with ready money, I am anſwerable for all he takes up; for the tradeſman cannot poſſibly diſtinguiſh when he comes by my order and when upon his own authority.

If a ſervant, laſtly, by his negligence does any damage to a ſtranger, the maſter ſhall anſwer for his neglect: if a ſmith's ſervant lames a horſe whilſt he is ſhoeing him, an action lies againſt the maſter, and not againſt the ſervant. But in theſe caſes the damage muſt be done while he is actually employed in the maſter's ſervice; otherwiſe the ſervant ſhall anſwer for his own miſbehaviour. Upon this principle, by the common law, if a ſervant kept his maſter's fire negligently, ſo that his neighbour's houſe was burned down thereby, an action lay againſt the maſter; becauſe this negligence happened in his ſervice: otherwiſe, if the ſervant going along the ſtreet with a torch, by negligence ſets fire to a houſe; for there he is not in his maſter's immediate ſervice, and muſt himſelf anſwer the damage perſonally. But now the common law is, in the former caſe, altered by ſtatute 6 Ann. c. 3. which ordains, that no action ſhall be maintained againſt any in whoſe houſe or chamber any fire ſhall accidentally begin; for their own loſs is ſufficient puniſhment for their own or their ſervant's careleſſneſs. But if ſuch fire happens through negligence of any ſervant (whoſe loſs is commonly very little), ſuch ſervant ſhall forfeit 100l. to be diſtributed among the ſufferers; and, in default of payment, ſhall be committed to ſome workhouſe, and there kept to hard labour for 18 months. A maſter is, laſtly, chargeable if any of his family layeth or caſteth any thing out of his houſe into the ſtreet or common highway, to the damage of any individual, or the common nuiſance of his majeſty's liege people: for the maſter hath the ſuperintendance of all his houſehold. And this alſo agrees with the civil law; which holds, that the *pater familias*, in this and ſimilar caſes, *ob alterius culpam tenetur, ſive ſervi, ſive liberi*.

We may obſerve, that in all the caſes here put, the maſter may be frequently a loſer by the truſt repoſed in his ſervant, but never can be a gainer: he may frequently be anſwerable for his ſervant's miſbehaviour, but never can ſhelter himſelf from puniſhment by laying the blame on his agent. The reaſon of this is ſtill the ſame; that the wrong done by the ſervant is looked upon in law as the wrong of the maſter himſelf; and it is a ſtanding maxim, that no man ſhall be allowed to make any advantage of his own wrong.

Maſter-Lead, in mining, a term uſed to expreſs the larger vein of a metal, in places where there are ſeveral veins in the ſame hill. Thus it often happens, that there are ſeven, ſometimes five, but more uſually three veins or loads, parallel to each other, in the ſame hill. Of theſe the middle vein is always much the largeſt. This is called the *maſter-load*; and the others which lie three, two, or one on each ſide of this, are called the *concomitants* of the maſter-load.

Master-Wort, in botany. See Imperatoria.

MASTICATION, the action of chewing, or of agitating the ſolid parts of our food between the teeth, by the motion of the jaws, the tongue, and the lips, whereby it is broken into ſmall pieces, impregnated with ſaliva, and ſo fitted for deglutition and a more eaſy digeſtion. See Anatomy, n° 104.

MASTICH, a kind of reſin exſuding from the lentiſcus tree; and brought from Chio, in ſmall yellowiſh tranſparent grains or tears, of an agreeable ſmell, eſpecially when heated or ſet on fire. See Pistachia.

This reſin is recommended in old coughs, dyſenteries, hæmoptoës, weakneſs of the ſtomach, and in general in all debilities and laxity of the fibres. Geoffroy directs an aqueous decoction of it to be uſed for theſe purpoſes: but water extracts little or nothing from this reſin. Rectified ſpirit almoſt entirely diſſolves it, and the ſolution is very warm and pungent. Maſtich is to be choſen in drops, clear, well-ſcented, and brittle.

We meet with a kind of cement ſometimes kept in the ſhops under the name of maſtich. It is compoſed of this gum and ſeveral other ingredients, and is formed into cakes for uſe. This is intended for the ſervice of lapidaries, to fill up cracks in ſtones, &c. but this is by no means to be uſed for any medicinal purpoſes.

MASTICOT, or yellow lead, is the calx or aſhes of lead gently calcined, by which it is changed to a yellow or lighter or deeper teint, according to the degree of calcination. Maſticot is ſometimes uſed by painters, and it ſerves medicinally as a drier in the compoſition of ointments or plaſters. The maſticot which is uſed by the Dutch as the ground of their glazing, is prepared by calcining a mixture of one hundred weight of clean ſand, forty-four pounds of ſoda, ſold in Britain under the name of barilla, and thirty pounds of pearl-aſhes.

MASTIFF-dog, or band-dog, (*canis villaticus* or *catenarius*), is a ſpecies of great ſize and ſtrength, and a very loud barker. Manwood ſays, that it derives its name from *maſe theſeſe*, being ſuppoſed to frighten away robbers by its tremendous voice. Great Britain was formerly ſo noted for its maſtiffs, that the Roman emperors appointed an officer in the iſland, with the title of *Procurator Cynegii*, whoſe ſole buſineſs was to breed, and tranſmit from thence to the amphitheatre, ſuch as would prove equal to the combats of the place. Strabo, lib. iv. tells us, that the maſtiffs of Britain were trained for war, and uſed by the Gauls in their battles. See Canis.

MASTIGADOUR, or slabbering-bit, in the manege, a ſnaffle of iron; all ſmooth, and of a piece, guarded with paternoſters, and compoſed of three halfs of great rings, made into demi-ovals, of unequal bigneſs; the leſſer being incloſed with the greater, which ought to be about half a foot high.

MASULAPATAN, a populous town of Aſia in the Eaſt Indies, and on the coaſt of Coromandel, in the dominions of the Great Mogul. It carried on a great trade, and moſt nations in Europe had factories here; but the Engliſh have now left it, and even the Dutch themſelves have not above a dozen people here to carry on the chintz trade. The inhabitants are Gentoos, who will not feed on any thing that has life; and they had a famous manufacture of chintz, which is greatly decayed ſince the Engliſh left off buying. The Great Mogul has a cuſtom-houſe here; and the adjacent countries abound in corn, tobacco, and timber for building. It is ſeated on the weſt ſide of the Bay of Bengal, 200 miles north of fort St George. W. Long. 81. 25. N. Lat. 16. 30.

MATACA, or Mantaca, a commodious bay in America, on the north coaſt of the iſland of Cuba. Here the galleons uſually come to take in freſh water in their return to Spain. It is 35 miles from the Havannah. W. Long. 85. 6. N. Lat. 25. 0.

MATAMAN, a country of Africa, bounded by Benguela on the north, by Monomotapa on the eaſt, by Cafraria on the ſouth, and by the Atlantic Ocean on the weſt. There is no town in it, and the inhabitants live in miſerable huts, it being a deſart country, and but little viſited by the Europeans.

MATAN, or MACTAN, an iſland of Aſia in the Eaſt-Indian ſea, and one of the Philippines. The inhabitants have thrown off the yoke of Spain; and it was near that Magellan was killed in April 1521.

Cape MATAPAN, the moſt ſouthern promontory of the Morea, between the gulph of Coran and that of Colo China.

MATARAM, a large town of Aſia, formerly the capital of an empire of that name in the iſland of Java. It is ſtrong by ſituation, and is ſeated in a very fertile, pleaſant, and populous country, ſurrounded with mountains. E. Long. 111. 25. S. Lat. 7. 55.

MATARO, a town of Spain in Catalonia; ſeated on the coaſt of the Mediterranean, 15 miles north-eaſt of Barcelona, and 35 ſouth-weſt of Gironne. It is a ſmall town, but induſtrious and well-peopled; and the environs abound in vineyards, which produce wine much famed for its flavour. It likewiſe contains ſeveral manufactories, and is conſidered as one of the richeſt and moſt active towns in Catalonia. E. Long. 2. 35. N. Lat. 41. 30.

MATCH, a kind of rope ſlightly twiſted, and prepared to retain fire for the uſes of artillery, mines, fire-works, &c.

It is made of hempen-tow, ſpun on the wheel like cord, but very ſlack; and is compoſed of three twiſts, which are afterwards again covered with tow, ſo that the twiſts do not appear: laſtly, it is boiled in the lees of old wines. This, when once lighted at the end, burns on gradually and regularly, without ever going out till the whole be conſumed: the hardeſt and drieſt match is generally the beſt.

Quick-Match. See *Quick-Match.*

MATCHING, in the wine trade, the preparing veſſels to preſerve wines and other liquors, without their growing ſour or vapid. The method of doing it is as follows: Melt brimſtone in an iron ladle, and when thoroughly melted, dip it into ſlips of coarſe linen-cloth, take theſe out, and let them cool: this the wine-coopers call a *match*. Take one of theſe matches, ſet one end of it on fire, and put it into the bung-hole of a caſk; ſtop it looſely, and thus ſuffer the match to burn nearly out: then drive in the bung tight, and ſet the caſk aſide for an hour or two. At the end of this time examine the caſk, and you will find that the ſulphur has communicated a violent pungent and ſuffocating ſcent to the caſk, with a conſiderable degree of acidity, which is the gas and acid ſpirit of the ſulphur. The caſk may after this be filled with a ſmall wine which has ſcarce done its fermentation; and bunging it down tight, it will be kept good, and will ſoon clarify: this is a common and very uſeful method; for many poor wines could ſcarce be kept potable even a few months without it.

MATE *of a Ship of War*, an officer under the direction of the maſter, by whoſe choice he is generally appointed, to aſſiſt him in the ſeveral branches of his duty. Accordingly he is to be particularly attentive to the navigation in his watch, &c. to keep the *log* regularly, and examine the line and glaſſes by which the ſhip's courſe is meaſured, and to adjuſt the ſails to the wind in the fore-part of the ſhip. He is to have a diligent attention to the cables, ſeeing that they are well *coiled* and kept clean when laid in the *tier*, and ſufficiently *ſerved* when employed to ride the ſhip. Finally, he is to ſuperintend and aſſiſt at the ſtowage of the hold, taking eſpecial care that all the ballaſt and proviſions are properly ſtowed therein.

Mate of a Merchant-Ship, the officer who commands in the abſence of the maſter thereof, and ſhares the duty with him at ſea; being charged with every thing that regards the internal management of the ſhip, the directing her courſe, and the government of her crew.

The number of mates allowed to ſhips of war and merchantmen is always in proportion to the ſize of the veſſel. Thus a firſt-rate man of war has ſix mates, and an Eaſt Indiaman the ſame number; a frigate of 10 guns, and a ſmall merchant-ſhip, but only one mate in each; and the intermediate ſhips have a greater or ſmaller number, according to their ſeveral ſizes, or to the ſervices on which they are employed.

DURA *and* PIA MATER, the names given by anatomiſts to the two membranes which ſurround the brain. See ANATOMY, n° 129, 130.

MATERA, a conſiderable town of Italy, in the kingdom of Naples, and in the Terra d'Otranto, with a biſhop's ſee, ſeated on the river Canapro. E. Long. 16. 43. N. Lat. 40. 51.

MATERIA MEDICA.

Of Claſſification.

A GENERAL name for every ſubſtance uſed in medicine, and by ſome extended even to every article uſed as food or drink.

Thus the materia medica becomes exceedingly extenſive: however, before we enter upon any particular diſcuſſion of the ſubject, it appears proper to give ſome general idea of medicines and their operation.

A *medicine*, properly ſo called, is a ſubſtance, which when applied to the living human body, makes ſuch an alteration in it as either to prevent the approach of diſeaſe, or to remedy a morbid ſtate when already preſent. Such ſubſtances as may be uſed for theſe purpoſes without any great preparation are called *ſimple medicines*, or *ſimples*; and with theſe the writers on materia medica are chiefly converſant. In treatiſes written profeſſedly on this ſubject, it is common to give a particular deſcription of each article, the characteriſtic marks by which it may be diſtinguiſhed from all other ſubſtances, and the methods by which an adulteration or an imperfection may be diſcovered in it, together with the doſe in which it can ſafely be given: but as all theſe particulars are taken notice of in different

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different parts of this work, it is only neceſſary here to mention the general claſſification, and enumerate the names of the various ſubſtances uſed in medicine, after giving, as hath been already promiſed, a brief and general account of their mode of operation.

Concerning the manner in which medicines act, phyſicians have greatly differed, and each has followed his own particular theory. The followers of Boerhaave have ſuppoſed their action to be directly upon the ſolids and fluids; while thoſe who build their theories on the hypotheſis of Hoffman have aſſerted, that all medicines act immediately upon the nervous ſyſtem, and from thence only in a ſecondary manner are their effects diffuſed over the ſolids and fluids. To diſcuſs this queſtion is not our buſineſs at preſent: neither indeed is it a matter of great conſequence whether it be diſcuſſed or not; ſeeing all parties muſt own, that certain effects follow the uſe of certain particular ſubſtances, whether theſe ſubſtances act firſt upon the nervous ſyſtem or upon the ſolids and fluids.

From their operations on the human body medicines are moſt uſually divided into claſſes. Some are found to have the property of rendering the ſolid parts of the body more lax than before, and are therefore called *relaxing* medicines: Others there are which have an effect directly contrary, and are therefore called *indurating* medicines: A third kind are found to excite inflammation in the part to which they are applied, and are therefore called *inflammatory* medicines: And, laſtly, a fourth kind are found remarkably either to increaſe or diminiſh the vigour of the body, or what is called the *tone* of the ſolids; and have therefore got the name of *tonics* if they increaſe, and *ſedatives* if they diminiſh, this tone.

Some medicines are ſuppoſed neither remarkably to increaſe nor diminiſh the tone of the ſolids; but to perform their office either by correcting ſome morbid matter in the body, or by evacuating it: in the former caſe they are called *alterants*, in the latter *evacuants*.

Theſe are the general diviſions or claſſes into which medicines are commonly divided; but when we begin more particularly to conſider their virtues, a great many inferior diviſions ariſe.—Of the relaxing medicines, ſome, when externally applied, are ſuppoſed only to ſoften the part; and in that caſe are called *emollients:* while others, which have a power of converting the humours ſtagnating in any inflamed part into pus, are called *maturants*, or *ſuppuratives*. Sedative medicines, externally applied, are ſometimes called *paregorics:* when taken internally, if they take off a ſpaſm then exiſting in the body, they are called *antiſpaſmodics*; if they mitigate pain, *anodynes*; if they produce a quiet ſleep, *hypnotics*; or if they produce a very deep and unnatural ſleep, together with a remarkable ſtupefaction of the ſenſes, they are then called *narcotics*.

Tonic medicines obtain the name of *corroboratives*, *analeptics*, or *nervine* medicines, when they ſlightly increaſe the contractile power of the ſolids; but of *aſtringents*, if they do this in a great degree, eſpecially if at the ſame time that they indurate the ſolids they alſo coagulate the fluids. Some of theſe medicines have received names from their ſuppoſed virtue of promoting the growth of the fleſh, conſolidating wounds, and ſtopping fluxes of blood: but it is now diſcovered that no medicines whatever are endowed with any ſuch powers; and therefore the diviſions into *ſarcotics traumatics*, or *vulneraries*, &c. are ſeldom uſed.—If aſtringent medicines are uſed with an intention to drive, by the conſtriction which they occaſion, any kind of matter from the ſurface towards the internal parts of the body, they are called *repellents*; but if they inſenſibly expel any kind of ſtagnating matter from the parts where it is contained, they are then called *diſcutients*; and laſtly, *ſtimulants*, or *attractives*, if they bring a greater flux of humours to the part to which they are applied.

Of Claſſification.

As to medicines of the inflammatory kind, they are divided into *veſicatories* or bliſters, which by their application raiſe watery bladders on the ſkin; and *catheretics*, *eſcharotics*, *or corroſives*, if they eat into and deſtroy the ſubſtance of the ſolid parts themſelves. Another ſubdiviſion has been added, viz. that of *rubefactive* medicines, or ſuch as only induce a redneſs on the part to which they are applied; but theſe belong to the veſicatories, and what proves only *rubefactive* to one will frequently bliſter another.

The alterants are divided into *abſorbents*, ſuch as by their alkaline quality neutralize and deſtroy any acid matter which may be in the ſtomach; and *antiſeptics*, or thoſe which correct any putrid matter in it; *coagulants* when they thicken the humours, and *reſolvents* if they thin them; *heating* medicines when they increaſe the velocity of the blood, and *refrigerating* if they diminiſh it.

The evacuating medicines are divided according to the nature of the humour they evacuate. Thus, if they evacuate the contents of the ſtomach by vomiting, they are called *emetics*; if they induce purging, they are called *cathartics*; if they only evacuate the immediate contents of the inteſtines, they are named *eccoprotics*; or if a moderate evacuation is produced, without ſickneſs or pain, they are called *laxatives*.—The medicines which gently promote the expulſion of humours through the pores of the ſkin, are called *diaphoretics*. If they do this in great quantity and with violence, they are called *ſudorifics*. Such as excite urine, are called *diuretics*. Such as produce their evacuation by the glands of the palate, mouth, and ſalival ducts, are called *ſalivating* medicines; thoſe which promote the evacuation of mucus from the throat, are called *apophlegmatics*; while thoſe which evacuate by the noſe, are called *ptarmics*, *errhines*, *ſternutatories*; and thoſe which promote the menſtrual flux, *emmenagogues*.—To the order of evacuants alſo ſome reduce thoſe medicines which expel any unnatural bodies, as worms, ſtones, and flatus. Thoſe which deſtroy worms are called *anthelmintics*; thoſe which diſſolve the ſtone in the bladder, *lithontriptics*; and ſuch as expel flatus, *carminatives*.

According to theſe diviſions Mr Vogel claſſes the articles of his Materia Medica; but Dr Lewis chooſes to arrange them according to the natural qualities of the ſubſtances themſelves, and not their effects on the human body.

Writers on the materia medica (he obſerves) have taken great pains in arranging the various articles of which it is compoſed, into different diviſions and ſubdiviſions, according to their real or reputed medicinal powers.

It has been imagined, that the whole materia medica is reducible under the three diſtinctions of *alteratives, evacuants,* and *reſtoratives:* the firſt comprehending all that has any power to alter the conſtitution, without ſenſibly increaſing or diminiſhing any of the natural evacuations; the ſecond, whatever viſibly promotes thoſe diſcharges; and the third, all that contributes to leſſen them, and make the increaſe greater than the waſte. Theſe diviſions being too general, they are broken into ſubdiviſions; and theſe again are further divided into different claſſes, under more reſtrained denominations, as cardiac, carminative, hyſteric, ſtomachic, &c.

Specious as this plan may appear to be, he imagines the execution of it, to any uſeful purpoſe, would require a far more extenſive knowledge of the nature and operation of medicines than has yet been attained to. A juſt and uſeful method of ſimples is ſcarcely to be expected, while thoſe properties on which the method is founded are imperfectly known, and in many articles only conjectural.

In all the arguments that have been hitherto contrived upon this plan, there appears a ſtriking incongruity among the ſeveral articles of which even the ultimate ſubdiviſions are compoſed; ſubſtances extremely diſſimilar being claſſed together, as cantharides and tea, tobacco and bran, hemlock and cowſlips, ſcurvy-graſs and raiſins, arum root and liquorice, wormwood and parſnips, cinnamon and nettles, raſberries and chalk, artichokes and alum, cloves and coffee, muſtard-ſeed and black cherries, &c. Nor are theſe incongruities to be laid always to the charge of the authors, the nature of the ſyſtem itſelf rendering them often unavoidable; for the particular effect which intitles a medicine to a particular claſs, may be produced by ſubſtances very diſſimilar, and even oppoſite, in their general powers: thus the alvine excretions are reſtrained by ſtarch, wax, tormentil-root, opium; among the capital diuretics are cantharides, nitre, ſalt, fixt alkaline ſalts, ſquills. It ſhould ſeem that the method of arrangement cannot be a juſt one which requires ſubſtances ſo diſcordant to be ranked together, and which further requires each of theſe ſubſtances to be ranked over again, in other claſſes, along with other ſubſtances to which they are equally diſcordant.

There is alſo a material imperfection in this ſcheme, even in the primary diviſions. Steel and its preparations act, in different circumſtances, both as evacuants and reſtoratives. Mercury and antimony afford, in their different preparations, both evacuants and alteratives; and there are many other drugs which are ſometimes uſed as alteratives, and ſometimes as evacuants; indeed, all evacuants, in diminiſhed doſes, ſeem to act merely as alteratives. It ſhould ſeem therefore, that "the diviſion of the whole materia medica into alteratives, evacuants, and reſtoratives," is a diviſion not founded in nature, even if there was no objection to the vague meaning of the appellations themſelves.

Carthuaſer has divided the materia medica on a plan which appears more rational. Inſtead of the operations of medicines in the human body, which are precarious, complicated, and greatly diverſified according to the doſe, the preparation, and the circumſtances of the patient, he takes for the baſis of his arrangement their more ſimple, obvious, and conſtant properties, as bitterneſs, ſweetneſs, aſtringency, acidity, &c. Having conſidered the nature of bitterneſs, for inſtance, in general, he examines what effects medicines poſſeſſed of this property are capable of producing in the body, and in what circumſtances they may be expected to be ſerviceable, and then proceeds to an account of the particular bitters.

This method is of real uſe, but its uſe is limited to a ſmall part of the materia medica. There are many of the medicinal ſimples, in which we can diſtinguiſh no prevailing qualities of this kind; there are many, in which different qualities are blended together; and many which, though ſimilar in theſe kinds of qualities, are very diſſimilar in their operations in the human body: thus though gentian and aloes agree in having a bitter taſte, and ſugar and manna in being ſweet, their medicinal virtues are reſpectively very different. Accordingly, the author is obliged in ſome caſes to depart from his general plan, and found the diviſion on the medicinal effects; he makes one claſs of purgatives and emetics, and another of vaporoſe inebriants and narcotics; this laſt claſs conſiſts of tobacco, elder-flowers, ſaffron, opium, and poppy-ſeeds, ſubſtances certainly very diſcordant in all their qualities that relate to medicinal intentions.

In this article, inſtead of attempting a medicinal diſtribution of the ſimples, which we apprehend not to be practicable to any good purpoſe, we ſhall, after Dr Lewis, adopt the alphabetical mode of arrangement, as poſſeſſing upon the whole a decided ſuperiority over every other. We ſhall, however, premiſe, from the ſame ingenious author, ſome general obſervations on certain claſſes of medicines, in Cartheuſer's manner; and thus preſerve the leſs exceptionable parts of his plan, with ſome amendments.

ART. I. ACIDS.

Claſs 1. *Vegetable*
- *native*; as ſorrel, wood-ſorrel, juice of lemon, oranges, barberries, and other fruits.
- *produced by fermentation*; as vinegar and tartar.

Claſs 2. *Mineral:* the acids of vitriol, nitre, and common ſalt.

THE medical effects of acids, duly diluted and given in proper doſes, are to cool, quench thirſt, correct a tendency to putrefaction, and allay inordinate motions of the blood. By theſe qualities, in hot bilious temperaments and inflammatory diſorders, they frequently reſtrain immoderate hæmorrhages, and promote the natural ſecretions; in ſome kinds of fever, they excite a copious diaphoreſis, where the warm medicines, called *alexipharmic*, tend rather to prevent this ſalutary diſcharge.

Vegetable acids, particularly the native juices of certain plants and fruits, have ſome degree of a ſaponaceous quality; by means of which they attenuate or or diſſolve viſcid phlegm and deterge the veſſels, and thus prove ſerviceable in ſundry chronical diſorders. Inveterate ſcurvies have ſometimes yielded to their continued uſe, eſpecially when given in conjunction with medicines of the acrid or pungent kind: experience has ſhown, that the acrid antiſcorbutics have much better effects when thus managed than when exhibited by themſelves; hence in the *ſucci ſcorbutici* of our diſpenſatory, Seville orange juice is uſefully joined to that of the *cochlearia* and *naſturtium*.

The mineral acids inſtantly coagulate blood: the vegetable dilute it, even when inſpiſſated or thickened by heat; in which ſtate, watery liquors will not mingle with it. Hence, in ſome fevers, where water runs off by the kidneys almoſt as pale and inſipid as it was drank. vegetable acids render the urine of the due colour and quality. The mineral acids (the ſpirit of nitre in particular) combined with vinous ſpirits, have a like effect.

Acids are prejudicial in cold, pale, phlegmatic habits, where the veſſels are lax, the circulation languid, bile deficient, and the power of digeſtion weak. In theſe caſes, an acid is often generated in the ſtomach, from milk and moſt vegetable foods; which, whilſt it continues in the firſt paſſages, occaſions uneaſineſs about the ſtomach, flatulencies, ſometimes griping pains of the bowels, and vomitings.

ART. II. INSIPID EARTHS *capable of* ABSORBING ACIDS.

Oyſter-ſhells,
Crabs claws and eyes ſo called,
Coral red and white,
Pearls,
Bezoar,
Chalk,
Some marles,
Limeſtones,
Marbles,
Spars.

The virtues of thoſe ſubſtances are, to abſorb or deſtroy acidities in the firſt paſſages, and conſequently to remove ſuch diſorders as proceed from that cauſe. The cordial, alexipharmic, antifebrile, and other like virtues attributed to theſe medicines, appear to have little foundation; or at beſt are only ſecondary ones. When united with the acid, they form a neutral ſaline compound, poſſeſſing ſome degree of an aperient and detergent quality, though too inconſiderable to be in general regarded.

The abſorbent earths were all ſtrangers to medicine in the earlier times, and their uſe does not ſeem to have been eſtabliſhed before the laſt century; when ſome practitioners, from an opinion that moſt kinds of diſeaſes proceeded from a preternatural acid, introduced a great variety of antacid bones both of the earthy and ſaline kind, and very liberally exhibited them on almoſt every occaſion.

It is certain, that in children, and adults of a weak conſtitution, and whoſe food is chiefly of the vegetable aceſcent kind, ſundry diſorders are occaſioned by acidities; theſe readily diſcover themſelves by ſour eructations, the pale colour of the face, and in children by the ſour ſmell and green colour of the alvine fæces, which are ſometimes ſo manifeſtly acid as to raiſe a ſtrong efferveſcence with alkaline ſalts. In theſe caſes, and theſe only, the uſe of abſorbent earths is indicated.

If there are really no acid juices in the ventricle, theſe earths are apt to concrete with the mucous matter uſually lodged there, into hard indiſſoluble maſſes; which have ſometimes been thrown up by vomit, or found in the ſtomach upon diſſection. Hence indigeſtion, loſs of appetite, nauſea, vomiting, obſtructions of the bowels, and other diſorders. Sometimes the ſtomach and inteſtines have been found lined with a cruſt, as it were, of theſe earthy bodies, which muſt not only have prevented the ſeparation of the gaſtric liquor, but likewiſe have cloſed the orifices of the lacteal veſſels, ſo as to obſtruct the paſſage of the chyle into the maſs of blood.

Some ſuppoſe the earthy powders capable (without the concurrence of any acid) of paſſing the lacteals along with the chyle: and allege, in ſupport of this opinion, that, when triturated with water, they are in part taken up and carried with it through a filter of paper; the filtrated liquor leaving, upon evaporation, a portion of whitiſh earthy matter. This experiment (allowing the conſequence to be juſtly drawn from it) is itſelf erroneous: the reſiduum proceeds from the earth naturally contained in the water, not from that employed in the experiment; for if pure diſtilled water be made uſe of, it will leave no reſiduum, though long triturated or digeſted with the earth.

All theſe bodies, particularly thoſe of the animal kind, contain, beſides their purely alkaline earth, a portion of glutinous matter. An inſtance of this we have in crabs-eyes, which if macerated in the weaker acids, or in the ſtronger ſufficiently diluted with water, the earthy part will be diſſolved, and the animal glue remain in form of a ſoft tranſparent mucilage. The glutinous ſubſtance increaſes their tendency to concrete in the ſtomach: and thence thoſe which contain leaſt thereof ſhould be preferred to the others. The mineral earths contain the leaſt of this kind of matter, and ſome of them are very eaſy of ſolution; chalk, for inſtance, which may therefore be given with greater ſafety than the animal abſorbents. Theſe ſubſtances diveſted of their conglutinating matter by means of fire, are reduced into acrimonious calces or limes, and thus become medicines of a different claſs.

The teeth, bones, hoofs, and horns of animals conſiſt of the ſame principles with the animal-abſorbents above mentioned, but combined in different proportions: the quantity of gelatinous matter is ſo large, as to defend the earthy part from the action of weak acids whilſt the earth, in its turn, protects the gluten from being eaſily diſſolved by watery liquors. Hence theſe bodies in their crude ſtate, though recommended as poſſeſſing ſingular virtues, are not found to have any virtue at all.

Experiments have been made for determining the degree of ſolubility, or comparative ſtrength of theſe earths; the principal of which are arranged in the two following tables, one taken from Langius and the other from Homberg.

TABLE of the quantity of Acid deſtroyed by different Abſorbents.

Ten grains of	Drops of Spirit of Salt.
Some kinds of Limeſtones	160
Oyſter ſhells	120
Chalk	100
Shells of Garden-ſnails	100
Calcined Cray-fiſh	100
Pearls	80
Tooth of the Sea-horſe	80
Volatile Salts	80
Fixed Salts	60
Coral, red and white	60
Crabs-eyes	50
Egg-ſhells	50
Mother-of-Pearl	50
Crabs-claws	40
Jaw-bone of the Pike fiſh	30

TABLE of the quantity of Abſorbent Earths ſoluble in Acids.

576 grains of Spirit of Salt diſſolved of	Crabs-eyes	216
	Mother-of-Pearl	144
	Pearls	128
	Oyſter-ſhells	156
	Hartſhorn	165
	Coral	186
	Oriental Bezoar	118
	Occidental Bezoar	123
	Quick Lime	199
	Slacked Lime	193
576 grains of Spirit of Nitre diſſolved.	Crabs-eyes	277
	Mother-of-Pearl	202
	Pearls	219
	Oyſter-ſhells	236
	Hartſhorn	234
	Coral	233
	Oriental Bezoar	108
	Occidental Bezoar	144
	Quick Lime	180
	Slacked Lime	216

Theſe experiments do not ſufficiently aſcertain the point intended by them: in the firſt ſett, the quantity of acid is too vague and indetermined; in the ſecond, we are not told whether the acid was perfectly ſaturated; and in both, the acids made uſe of were ſo very different from any that can be ſuppoſed ever to exiſt in the human body, that little can be concluded from them with regard to the medical effects of theſe abſorbents. Trial ſhould have been made with the mild vegetable acids, as the juices of certain fruits, ſour fermented liquors, or rather with ſour milk. Nevertheleſs theſe tables, though not ſo perfect as could be wiſhed, have their uſe in the hands of ſuch as can make proper allowances.

ART. III. EARTHS *not* DISSOLUBLE in *Acids or other liquors.*

Theſe may be ranged in two claſſes.

Claſs 1. *Hard cryſtalline earths:* as the ruby, garnet, emerald, ſapphire, hyacinth, and other precious ſtones, cryſtal, flint, &c.

THESE kind of ſubſtances were introduced into medicine, and many fabulous virtues attributed to them by the ſuperſtition of the earlier ages. Some of them are ſtill preſerved in foreign pharmacopœias, but at length very juſtly expunged from ours, notwithſtanding what ſome late writters of repute ſpeak of their medical virtue. Theſe indiſſoluble hard bodies are not capable of producing any other effect, than by their rigid angular particles (which, though levigated with the utmoſt care, the microſcope ſtill diſcovers in them) to offend or wound the inteſtines. In levigation, they wear off ſo much from the hardeſt marble inſtruments, as will equal or exceed their own weight: from this circumſtance we may account for their having ſometimes appeared to act as abſorbents. Some of theſe ſtones, expoſed to a vehement fire, become in ſome meaſure friable; but nevertheleſs remain indiſſoluble. Moſt of the coloured ones by this treatment loſe their colour; and in this ſtate prove nearly of the ſame quality with common cryſtal: ſuch are, the ſapphire, emerald, amethyſt, and cornelian. Others melt into a blackiſh vitreous matter, from which a portion of iron is obtainable by proper fluxes; as the hyacinth and garnet. Geoffroy concludes from hence, that theſe ſtones really poſſeſs ſome medical virtues, depending upon their metallic part; but the quantity of metallic matter ſufficient to give them a conſiderable tinct, is ſo exceedingly ſmall, and ſo incloſed in a ſtony matter not at all ſoluble by any of the known menſtrua, as ſcarce to admit of any poſſibility of its acting in the human body.

Claſs 2. *Softer earths;* the talky, gypſeous, and argillaceous.

THE talcs and gypſums have rarely been uſed as medicines. Some of the former, from their unctuous ſoftneſs and ſilver hue, ſtand recommended externally as coſmetics; and ſome of the latter, on little better foundation, internally as aſtringents. But they have long been deſervedly rejected by the judicious practitioners. They ſeem to poſſeſs the ill qualities of the alkaline earth (concreting with the mucus of the ſtomach, &c.), without any of their good ones.

Several of the clays, boles, and terræ ſigillatæ, were highly celebrated by the ancients as aſtringents and alexipharmics, and ſome of them ſtill continue in eſteem; though it is certain they have no great claim to the virtues that have been attributed to them. Their real effects are, to give a greater degree of conſiſtency to the fluids in the firſt paſſages, and in ſome meaſure defend the ſolids from their acrimony.

Moſt of theſe bodies contain, beſides the tenacious indiſſoluble earth, which is their principal characteriſtic, (1.) A portion of an earth ſoluble in acids ſimilar to thoſe of the firſt ſection. (2.) Of acid, ſeparable by diſtillation in a ſtrong fire; this acid is always of the ſame nature with that obtained from vitriol, ſulphur, and alum. (3.) The coloured ones contain likewiſe ſmall quantities of iron, reducible, by inflammable fluxes, into its metallic form. In conſequence of the firſt of theſe ingredients, theſe earths may be looked upon in ſome meaſure as abſorbent; the acid earth into a ſaline compound, approaching to an aluminous nature; whence they have ſome degree of aſtringency:

Glutinous and Unctuous Subſtances.

gency: whether they receive any peculiar virtue from the iron, is greatly to be doubted; ſince it is in a very crude ſtate, and in quantity extremely ſmall.

Theſe earths unite with water into a turbid liquor, ſlippery and ſmooth to the touch, and remain for ſome time ſuſpended; the ſand, grit, or other groſſer matters, which are often found naturally mingled with them ſubſiding. They may be freed by means of acids from their alkaline earth; by coction in water, from their ſaline matter; and the coloured ones from their iron by digeſtion in aqua-regis, the only menſtruum we are acquainted with that will extract the ferrugineous matter of argillaceous and bolar earths. Thus purified, they have all nearly the ſame appearance and equalities. Expoſed to a ſtrong fire, they loſe their ſoft glutinous quality, and are reduced into hard maſſes, indiſſoluble as at firſt.

ART. IV. GLUTINOUS *Vegetable and Animal Subſtances.*

Claſs 1. *Vegetable.*

Pure gums:	Vegetables abounding with mucilage:
Tragacanth,	Orchis root,
Seneca,	Althæa root,
The gums of cherry, plum, and other European trees.	Quince-ſeeds, &c.

GUMS and mucilages are glutinous vegetable productions of no particular taſte or ſmell, ſoluble in water, but not in vinous ſpirits or in oils. They differ from one another only in degree of tenacity; the more tenacious are called *gums;* thoſe which are leſs ſo, *mucilages.* The firſt naturally exſude from certain trees and ſhrubs; the latter are extracted by art. Almoſt all vegetable ſubſtances contain ſome portion of theſe, which, after the reſinous part has been extracted by ſpirit, may be ſeparated from the remaining matter by means of water.

The general virtues of theſe kinds of ſubſtances are, to thicken the fluids, and defend the ſolids from them when grown ſharp or corroſive. Hence their uſe in a thin acrimonious ſtate of the juices, and where the natural mucus of the inteſtines is abraded.

Claſs 2. *Animal.*

MOST animal ſubſtances (the fat excepted) contain a viſcous matter, in many reſpects ſimilar to the foregoing, and capable of being extracted by ſtrong coction in water.

Animal glues and gellies have the general qualities of the vegetable gums and mucilages; with this difference, that the former are more nutrimental, and apt to run into a putrid ſtate. Conſidered as the ſubjects of chemiſtry, the difference betwixt them is very great: thoſe of the animal kind are changed by fire into a volatile alkaline ſalt, and a fetid oil; the vegetable into an acid liquor, and a very ſmall portion of oily matter conſiderably leſs fetid than the former.

ART. V. *Soft* UNCTUOUS *Subſtances.*

Claſs 1. *Inſipid vegetable oils; and ſubſtances abounding with them;* as almonds, and the kernels of moſt fruits; linſeed, and the medullary part of ſundry other ſeeds.

Claſs 2. *Animal fats;* as ſpermaceti.

UNCTUOUS vegetables unite with water, by trituration, into a milky liquor; and give out their oil upon expreſſion.—Theſe kinds of oils and animals-fats diſſolve not in any menſtruum except alkaline ones; which change their quality, and reduce them into a ſoap, diſſoluble in water, but more perfectly in vinous ſpirits; from this compound, the oil may, by a ſkilful addition of acids, be recovered in a purer ſtate than before, and rendered ſoluble, like eſſential oils, in ſpirit of wine.

The medical virtues of theſe ſubſtances are, to obtund acrimonious humours, and to ſoften and relax the ſolids; hence their uſe internally in tickling coughs, heat of urine, pains, and inflammations; and externally in tenſion and rigidity of particular parts. The milky ſolutions, commonly called *emulſions,* though much leſs emollient than the oils themſelves or animal-fats have this advantage, that they may be given in acute or inflammatory diſtempers, without danger of the ill conſequences which the others might ſometimes produce; fats and oils, kept in a degree of heat no greater than that of the human body, ſoon become rancid and acrimonious; whilſt emulſions tend rather to grow ſour.

Aſtringents.

ART. VI. ASTRINGENTS.

Galls,
Tormentil-root,
Biſtort-root,
Balauſtines,
Terra Japonica,
Acacia, &c.

ASTRINGENT ſubſtances are diſtinguiſhed by a rough auſtere taſte; and changing ſolutions of iron, eſpecially thoſe made in the vitriolic acid, of a dark purple or black colour.

Aſtringents yield their virtues by infuſion both to water and vinous ſpirits, generally in greateſt perfection to the former. Oils extract nothing from them; nor do they give over any of their virtue in diſtillation: nevertheleſs their aſtringency is conſiderably abated by evaporating decoctions of them to the conſiſtence of an extract, and totally deſtroyed by long keeping.

The medical effects of theſe kinds of ſubſtances are, to conſtringe the fibres; and incraſſate or lightly thicken the juices. Their more experienced uſe is in diſorders proceeding from a debility or flaccid ſtate of the ſolids; in hæmorrhages, from a thinneſs of the blood, laxity or rupture of the veſſels; in preternatural diſcharges of other kind, after the offending matter has been duly corrected or evacuated; and in external relaxations.

In ſome caſes, they produce the effects of aperients; the veſſels, conſtringed and ſtrengthened by them, being enabled to protrude the circulating juices with greater force.

A good deal of caution is requiſite in the uſe of theſe medicines, eſpecially thoſe of the more powerful kind. In plethoric habits, inveterate obſtructions, critical evacuations; and in all kinds of fluxes in general before the morbific matter has been expelled, or where there is any ſtricture or ſpaſmodic contraction of the veſſels, aſtringents prove eminently hurtful. Where critical dyſenteries or diarrhœas are reſtrained by ſtyptics, the acrimonious matter, now confined in the inteſtines, corrodes or inflames them; and ſometimes occaſions a gangrene of the parts.

Sweets and Acrids.

ART. VII. Sweets.

Sugar, Raiſins,
Honey, Liquorice, &c.

THE vegetable ſweets are a very numerous tribe; almoſt every plant that has been examined, diſcovering in ſome of its parts a ſaccharine juice. The bottoms of flowers, and moſt kinds of ſeeds and grain when they begin to vegetate, are remarkably ſweet.

Vegetable ſweets are extracted both by water and vinous ſpirits, moſt readily by the firſt, but in greateſt perfection by the latter. Nothing of their taſte ariſes in diſtillation with either of theſe liquors; nevertheleſs by long boiling with water they become ſomewhat leſs agreeable; but are not much injured by being treated in the ſame manner with rectified ſpirit.

The purer ſweets, as ſugar, promote the union of diſtilled oils with watery liquors, and prevent the ſeparation of the butyraceous part from mild: from this quality, they are ſuppoſed to unite the unctuous part of the food with the animal juices. Hence ſome have concluded, that they increaſe fat: others, that they have a contrary effect; by preventing the ſeparation of the unctuous matter which forms the fat from the blood: and others, that they render the juices thicker and more ſluggiſh, retard the circulation and cuticular excretion, and thus bring on a variety of diſorders. But ſweets have not been found to produce any of theſe effects in any remarkable degree: common experience ſhows that their moderate, and even liberal, uſe is at leaſt innocent; that they reconcile, not only to the palate, but to the ſtomach alſo, ſubſtances of themſelves diſguſtful to both; and thus render ſalutary what would otherwiſe be injurious to the body.

The unctuous and mucilaginous ſweets, as the impure ſugars, liquorice, &c. have a conſiderable degree of emollient and lubricating virtue.—Thoſe accompanied with a manifeſt acid, as in the juices of moſt ſweet fruits, are remarkably relaxing: and if taken immoderately, occaſion diarrhœas and dyſenteries, which ſometimes have proved fatal.

ART. VIII. ACRIDS.

Yielding their acrimony
1. In diſtillation with water: as horſe-radiſh, muſtard, ſcurvy-graſs, &c.
2. By infuſion only: as the greater celandine, pyrethrum, &c.
3. Neither to infuſion, nor diſtillation: as arum and dracunculus.

ACRIDS are ſubſtances of a penetrating pungency. Applied to the ſkin, they inflame or exulcerate it: chewed, they occaſion a copious diſcharge of ſaliva: and ſnuffed up the noſe, they provoke ſneezing.

Theſe ſubſtances, conſidered as the ſubjects of pharmacy, may be divided into three claſſes.

The general effects of acrid medicines are, to ſtimulate the veſſels, and diſſolve tenacious juices. In cold leucophlegmatic habits, ſtagnations of the fluids, and where the contractile power of the ſolids is weak they prove powerful, expectorants, deobſtruents, diuretics, and emmenagogues; and if the patient is kept warm, ſudorifics. In hot bilious conſtitutions, plethoric habits, inflammatory diſtempers, where there is already a degree of irritation, where the juices are too thin or acrimonious, or the viſcera unſound, theſe ſtimulating medicines prove highly prejudicial, and never fail to aggravate the diſeaſe.

Aromatics and Bitters.

Certain acrid ſubſtances have been lately recommended in dry convulſive aſthmas; of the efficacy of the ſquill in particular, for the cure of this diſorder, ſeveral inſtances are related in the *commercium Literarium*, of Norimberg for the years 1737 and 1739. Carthenſer thinks, that not the aſthma itſelf, but a particular effect of it, was removed by this medicine. He obſerves, that in all aſthmas the free circulation of the blood through the pulmonary veſſels is impeded; and hence, during every paroxyſm, the lungs are in a kind of œdematous ſtate: that if this œdema, becoming habitual, remains after the fit is over, it is either perpetually occaſioning freſh ones, or gives riſe to a dropſy of the breaſt: that acrid medicines, by removing the œdema, remove what was originally an effect of the aſthma, and in time a cauſe of its aggravation.

ART. IX. AROMATICS.

AROMATICS are ſubſtances of a warm pungent taſte, and a more or leſs fragrant ſmell. Some of the ſpices are purely aromatic, as cubebs, pepper, cloves; ſome ſubſtances have a ſweetneſs mixed with the aromatic matter, as angelica-root, aniſeed, fennel-ſeed; ſome an aſtringency, as cinnamon; ſome a ſtrong mucilage, as caſia lignea; ſome a bitterneſs, as orange-peel. The aromatic matter itſelf, contained in different ſubjects, differs alſo not a little in its pharmaceutic properties. It is extracted from all by rectified ſpirit of wine; from ſome in great part, from others ſcarcely at all, by water. The aromatic matter of ſome ſubjects, as of lemon-peel, riſes wholly in diſtillation both with ſpirit and water; that of others, as cinnamon, riſes wholly with water, but ſcarcely at all with ſpirit; while that of others as pepper, is in part left behind after the diſtillation of water itſelf from the ſpice.

With regard to the general virtues of aromatics, they warm the ſtomach, and by degrees the whole habit; raiſe the pulſe, and quicken the circulation. In cold languid caſes, phlegmatic habits, and a weak flaccid ſtate of the ſolids, they ſupport the vis vitæ, and promote the ſalutary ſecretions. In hot bilious temperaments, plethoric habits, inflammatory indiſpoſitions, dryneſs and ſtrictures of the fibres, they are generally hurtful.

ART. X. BITTERS.

Gentian root, Leſſer centaury.
Hops, Carduus, &c.

BITTERS for the moſt part yield their virtue both to watery and ſpirituous menſtrua; ſome more perfectly to one, and others to the other. None of the ſubſtances of this claſs give over any thing conſiderable of their taſte in diſtillation, either to water, or to ſpirit; their bitterneſs remaining entire, and frequently improved, in the extracts. Such as are accompanied with flavour, as wormwood, by this proceſs, may be reduced into ſimple flavourleſs bitters.

Theſe ſubſtances participate of the virtues of aſtringents and aromatics. Their general effects are, to conſtringe the fibres of the ſtomach and inteſtines, to warm the habit, attenuate the bile and juices in the firſt paſſages, and promote the natural evacuations, particularly of ſweat and urine. In weakneſs of the ſtomach, loſs of appetite, indigeſtion, and the like diſorders, proceeding from a laxity of the ſolids, or cold ſluggiſh indiſpoſition of the juices, theſe kinds of medicines do good ſervice. Where the fibres are already too tenſe and rigid, where there is any immoderate heat or inflammation, bitters very ſenſibly increaſe the diſtemper; and, if their uſe is continued, communicate it to the kidneys: hence the urine becomes high-coloured, ſmall in quantity, and at length ſuppreſſed; a dropſy ſoon ſucceeding. If the kidneys were before ſo lax as to remain now uninjured, yet the other viſcera become gradually more and more rigid, and a tabes is at length brought on.

Bitter ſubſtances deſtroy inſects, and prevent putrefaction. Hence they are recommended as anthelmintic, and externally as antiſeptics.

ART. XI. EMETICS *and* CATHARTICS.

Hellebore,
Jalep,
Ipecacuanha,
Colocynth,
Scammony,
Gamboge, &c.

THESE ſubſtances conſiſt of a reſinous part, in which the purgative or emetic quality reſides: and a gummy ſaline one, which acts chiefly as a diuretic. The firſt is extracted or diſſolved by vinous ſpirits; the latter by water. Nothing ariſes in diſtillation from either.

The acrid reſins, exhibited by themſelves, tenaciouſly adhere to the coats of the inteſtines, by their ſtimulating power irritate and inflame them, and thus produce ſundry violent diſorders. Hoffman relates, that he has ſometimes obſerved convulſions, and a paralyſis of both ſides, from their uſe.

Theſe inconveniences may be avoided, by previouſly triturating them with ſubſtances capable of dividing their tenacious texture, and preventing their adheſion; by this means they become mild and ſafe, operate without diſturbance, and at the ſame time more effectually anſwer the purpoſes intended by them.

Some have endeavoured to correct the ill quality of the reſinous purgatives, by the addition of acids and aromatic oils. Acids weaken their power, but have no other effect than what a diminution of the doſe would equally anſwer. The pungent eſſential oils may ſerve to warm the ſtomach, make the medicine ſit eaſier, and thus prevent the nauſea which ſometimes happens; but as ſoon as the reſin begins to exert itſelf in the inteſtines, theſe oils, inſtead of correcting, increaſe its virulence; being themſelves apt to occaſion the inconveniences which they are here intended to prevent, an irritation and inflammation of the bowels. Alkaline ſalts or ſoaps have a better effect; as they diſpoſe the reſin to ſolution, and promote its operation.

The medicines of this claſs ſeem to act by liquefying the juices, and ſtimulating the coats of the ſtomach and inteſtines. If the irritation is ſtrong and ſudden, their action is quick and upwards: if ſlower, downwards. Cathartics given in a liquid form, or in very ſenſible habits, often prove emetic; and emetics, where mucus abounds, cathartic. They operate more violently in robuſt conſtitutions than in thoſe of a contrary temperament; the veſſels being in the former more tenſe and rigid, and conſequently leſs capable of of bearing an equal degree of irritation.

The action of theſe medicines is extended beyond the primæ viæ: This appears evident from the increaſe of the pulſe which always accompanies their operation; and from the common obſervation of children being purged by the milk, if the nurſe has taken a carthartic. Some of them, particularly hellebore, are ſaid to purge, if only applied externally in iſſue.—Purgatives, even of the more powerful kind, exhibited in ſuitable ſmall doſes, in conjunction with the milder aperients, may be introduced into the habit, ſo as to prove notable deobſtruents, diuretics, and diaphoretics, without acting ſenſibly by ſtool.

A CATALOGUE *of the* SIMPLES *uſed in the* MATERIA MEDICA, *exhibiting at one view their* TECHNICAL NAMES, ENGLISH NAMES, PARTS USED IN MEDICINE, VIRTUES, *and the different* PREPARATIONS FROM THEM.—*A particular account of the different articles of this liſt is given in the courſe of the alphabet, chiefly under the Linnæan names: And the methods of making the preparations from them are ſhown under the article* PHARMACY. *The notes ſubjoined at the bottom of the following pages are intended to ſupply ſome particulars relating to a few of the detached articles already paſt.*

TECHNICAL NAMES.	ENLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Abies ruber (*Pinus abies*, Lin.)	The fir-tree.	The wood, tops, and cones.	Diuretic and diaphoretic.	A decoction.
Abrotanum fœmina (*Santolin chamæcypar*. Lin.)	Lavender cotton.	The leaves.	Stimulant, detergent, and anthelmintic.	Decoction, and ointment for cutaneous eruptions.
Abrotanum mas (*Artemiſia abrotanum*, Lin.)	Southernwood.	The leaves.	Stimulant, detergent, aperient, and ſudorific,	Decoction and tincture; alſo lotion and ointment for cutaneous eruptions.
Abſinthium maritimum (*Artemiſia maritima*, Lin.)	Sea wormwood.	The tops.	Stomachic.	An oil, extract, conſerve, and ſeveral diſtilled tincture-waters. They alſo enter the common fomentation and green oil.
Abſinthium vulgare (*Artemiſia abſinthium*, Lin.)	Common wormwood.	The leaves and flowering tops.	Stomachic.	

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Acacia Germanica (*Prunus ſpinoſa*, Lin.)	The ſloe.	Inſpiſſated juice.	Aſtringent.	
Acacia vera) *Mimoſanilotica*, Lin.)	Acacia.	Inſpiſſated juice.	Aſtringent.	
Acetoſa (*Rumex acetoſ.* Lin.)	Sorrel.	Leaves.	Aſtringent and antiſcorbutic.	An eſſential ſalt for taking out ſpots in clothes. A decoction.
Acetoſella (*Oxalis acetoſel.* Lin.)	Wood ſorrel.	The leaves.	Aſtringent and an antiſcorbutic.	A conſerve.
Acetum.	Vinegar.		Cordial, refrigerant, ſudorific, and antiſeptic.	A diſtilled ſpirit.
Aconitum (*A. napellus*, Lin.)	Wolf's-bane.	The herb & leaves.	Narcotic.	Tincture.
Acorus. See *Calamus arom.* infra.				
Adianthum verum (*Adianth. capill. Ven.* Lin.)	Maiden-hair.	The leaves.	Attenuating and aperient.	Decoction and ſyrup; its virtues beſt obtained from an infuſion of the herb ſweetened with ſugar and liquorice, and drank as tea.
Aer dephlogiſticus.	Dephlogiſticated air.		Suppoſed to be antiſeptic and corroborative.	
Aer mephiticus.	Fixed air.		Antiſeptic and lithontriptic.	
Aer nitroſus.	Nitrous air.		Very antiſeptic.	
Æs. See *Cuprum.*	Braſs. See *Copper.*			
Agaricus, (*Boletus pini laricis*, Lin.)	Agaric.		Cathartic.	An aqueous extract, but now much diſuſed.
Agaricus chirurgorum (*Boletus igius*, Lin.)	Female agaric, or agaric of the oak, touchwood, or ſpunk.		Styptic.	Pieces applied externally.
Agnus caſtus (*Vitex agnus caſtus*, Lin).	The chaſte-tree.	The ſeeds.	Antaphrodiſiac.	
Agrimonia (*A. Eupator.* Lin.)	Agrimony.	The leaves.	Attenuant and tonic.	Digeſted in whey, it forms, a diet-drink uſed by ſome in the ſpring.
Albumen ovi.	White of an egg.		Diſcutient.	
Alchemilla (*A. vulgaris*, Lin.)	Ladies-mantle.	The leaves.	Aſtringent.	
Alkekengi, (*Phyſalis alkakengi*, Lin.)	Winter-cherry.	The fruit.	Aperient and diuretic.	Dried and powdered. Inſpiſſated juice.
Alliaria (*Eryſimum allaria*, Lin.)	Sauce-alone, or Jack-by-the-hedge.	The leaves.	Sudorific and deobſtruent.	
Allium (*A. ſativum*, Lin.)	Garlic.	The roots.	Stimulant, attenuant, diſcutient, and diuretic.	A ſyrup and oxymel, ointment and poultice.
Alnus (*Betula alnus*, Lin.)	Alder.	Leaves and bark.	Aſtringent.	Decoction. The leaves chopt and heated, efficacious for diſperſing milk in the breaſts.
Aloes (*Aloe perfoliata*, Lin.)	Aloes.	Inſpiſſated juice.	Cathartic.	Ingredient in ſeveral tinctures and pills.
Alſine (*A. med.* Lin.	Chickweed.	The leaves.	Refrigerant.	

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Althæa (*A. officinalis*, Lin.)	Marſhmallow.	The leaf and root.	Emollient.	A ſyrup and ointment.
Alumen.	Alum.	The whole.	Strongly aſtringent	A ſtyptic powder, ſtyptic water, whey, &c.
Ambragriſea.	Ambergriſe.	The whole.	A high cordial.	A tincture or eſſence.
Ammi vulgaris.	Biſhop's weed.	The leaves.	Stimulant.	An ingredient in the theriaca.
Amomum verum.	True amomum.	The ſeeds.	Aromatic.	An ingredient in the theriaca.
Amomum vulgare (*Siſon. amomum* Lin).	Baſtard ſtone-parſley.	The ſeeds.	Carminative and diuretic.	
Ammoniacum. See *Gummi*.				
Amygdala (*Am. con.* Lin.)	Sweet and bitter almonds.	The fruit.	Relaxing.	Expreſſed oil and emulſion.
Amylum.	Starch.	The nuts.	Aſtringent.	Oil outſide, but the kernels uſed as almonds; the gum inſtead of gum arabic.
Anacardium occidentale, (Lin.)	Caſhew-tree.		Corroſive.	
Anagallis (*Arvenſis*, Lin.)	Pimpernel.	The leaves.	Sudorific and nervine.	Extract, or inſpiſſated juice.
Ananas (*Bromelia ananas*, Lin.)	The pine-apple.	The fruit.	Refrigerant.	
Anchuſa (*A. tinctoria*, Lin.)	Alkanet.	The root.	Only uſed for its colour.	
Anethum (*A. graveolens*, Lin.)	Dill.	The ſeeds.	Carminative.	Diſtilled oil, water, and ſpirituous extract.
Angelica (*A. Archangelica, and ſylveſtris*, Lin.)	Angelica.	The roots, ſtalks, leaves, and ſeeds.	Aromatic.	Several compound waters.
Anguſturæ cortex, (A)				
Aniſum (*Pimpinella aniſum*, Lin)	Aniſe.	The ſeed.	Aromatic and tonic.	An eſſential oil, a ſpirituous compound water, &c.
Antimonium.	Antimony.		Diaphoretic, cathartic, emetic, or cauſtic.	A number of chemical preparations. See CHEMISTRY, *Index*, KERMES *Mineral*, and REGULUS *of Antimony*.
Aparine (*Gallium aparine*, Lin.)	Gooſegraſs, or clivers.	The leaves.	Aperient.	
Apium (*A. graveol.* Lin.)	Smallage.	The roots, leaves, and ſeeds.	Carminative.	Diet-drinks.
Aqua marina.	Sea-water.		Cathartic and alterative.	
Aquæ minerales.	Mineral waters.		Tonic and alterative.	
Aquæ ſulphureæ.	Sulphureous waters.		Alterative and anthelmintic.	
Argentina (*Potentill. argentin.* Lin.)	Silverweed.	The leaves.	Corroborant.	
Argentum vivum.	Quickſilver.		A moſt powerful alterant.	Several chemical preparations; ſee CHEMISTRY-*Index*. An ingredient in ſeveral other officinal preparations.

Ariſto-

(A) The Anguſtura bark was firſt imported from the Weſt Indies in 1788; but it is a native of Africa. Mr Bruce who had been cured of a dyſentry in Abyſſinia by the bark of a plant called there *Wooginos*, brought the ſeeds from that country, and the plant is now cultivated in Kew gardens and other places under the name of *Brucea antidyſenteria*, or *ferruginea*. He ſuppoſed the bark of this was the ſame with that of the Anguſtura; but Dr Duncan, in the Medical Commentaries for 1790, ſays that they are totally different when compared together. For an account of the Anguſtura bark, ſee *JESUIT's Bark*.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Ariſtolochia (*A. clematitis*. Lin.)	Birthwort.	The roots.	Attenuating, ſtimulant, and detergent.	
Armeniaca (*Prunus Armeniaca*, Lin.)	The plum-tree.	The fruit and gum.	The fruit refrigerant, and the gum demulcent.	
Arnica (*A. montana*, Lin.)	German leopards's bane.	The herb, flowers, and roots.	Antiſpaſodic; emetic, cathartic.	A warm infuſion.
Arſenicum. (B)	Arſenic.		Corroſive.	
Artemiſia (*A. vulgaris*, Lin.)	Mugwort.	The leaves.	Antiſpaſmodic.	Infuſion.
Arum (*A. maculatum*, Lin.)	Wake-robin.	The root.	Stimulant.	A compound powder and conſerve (C).
Aſafetida. See *Gummi*, infra.				
Aſarum (*A. Europæum*, Lin.)	Aſarabacca.	The leaves.	Errhine, cathartic, and emetic.	A compound powder (D)
Aſparagus (*A. Officinalis*, Lin.)	Aſparagus.	The roots.	Suppoſed diuretic but uncertain.	
Aſperula.	Woodruff.	The flowers.	Attenuant and aperient.	

Aſphodelus,

(B) This pernicious mineral has ſome time ago been introduced into medicine as a certain remedy for cancers; but Mr Juſtamond, who publiſhed a treatiſe on this ſubject two or three years ago, informs us, that even the moſt guarded uſe of it in the external way, while it produces the happieſt effects in healing cancerous ulcers, yet occaſions ſuch diſagaeeable ſymptoms of the paralytic kind, that it cannot be perſiſted in. The lateſt trials in London are likewiſe ſaid to confirm this account; notwithſtanding which, however, the internal uſe of it has ſince gained ground in a variety of diſorders, particularly in intermitting fevers, which are ſaid to be readily cured by it ſometimes after the bark and all other remedies had failed. A ſolution of the mineral is given by drops, from one ſixteenth to a ſix part of a grain for a doſe, largely diluted in a warm aqueous liquid. Dr Aikin recommends oil and milk as a certain remedy againſt this deſtructive poiſon. He quotes from Hoffman an inſtance where ſeveral perſons of diſtinction had taſted food mixed with arſenic inſtead of ſugar. All of them were ſeized with anxiety at the breaſt, pain at the ſtomach, tremor of the lips, and reachings. Milk and oil were given in great plenty, and they continued ſtrongly vomiting for half a day. Some vomited no leſs than 100 times; but all of them recovered. Some inſtances of a ſimilar kind have come within the Doctor's own knowledge. Sage in his Mineralogy relates, that the regulus is much leſs dangerous than the calx or glaſs: he ſays that on giving half an ounce to a cat, the animal only grew meagre for ſome time, but afterwards became fat again. He ſays that acids, particularly vinegar, are the antidotes to this poiſon; and that oils and emulſions do not ſo effectually obtund this poiſon as acids do. Of this he has had experience in brutes. He adds, that the regulus is not ſoluble in water, and that the founders are more afraid of fumes of lead than arſenic.

(C) Dr Aikin informs us, that the inſupportable pungency on the tongue, which has hitherto prevented it from being uſed in a freſh ſtate ſo as to exert its full virtues, is effectually covered by unctuous and gummy materials. The freſh root beaten into a ſmooth maſs, with the addition of a little teſtaceous powder which promotes the diviſion of it, may be either mixed with about an equal quantity of powdered gum arabic, and three or four times as much conſerve, ſo as to make them into an electuary; or rubbed with a thick mixture of mucilage of gum arabic and ſpermaceti, gradually adding any ſuitable watery liquors, and a little ſyrup in order to form an emulſion, two parts of the root, two of gum, and one of ſpermaceti, make an emulſion, which ſcarce impreſſes any degree of pungency upon the tongue though kept long in the mouth. In theſe forms our author has given the freſh root from ten grains to more than a ſcruple, three or four times a-day: it generally occaſioned a ſlight ſenſation of warmth, firſt about the ſtomach and then in the remoter parts; manifeſtly promoted perſpiration, and frequently produced a plentiful ſweat. Several obſtinate rheumatic pains have been removed by the uſe of this preparation, which our author therefore recommends to further trial.

(D) The leaves of this plant are by ſome ſuppoſed to be more powerful than the roots as emetics and cathartics, but they are milder as errhines. Geoffroy relates, that a ſingle doſe of the errhine of which this root is an ingredient has occaſioned a diſcharge for three days: and that he has known a palſy of the mouth and tongue cured by the ſame means. He recommends it in ſtubborn diſorders of the head proceeding from viſcid matters, in palſies, and lethargic diſtempers. During its operation the patient muſt carefully avoid cold; which is apt to produce puſtules, inflammations, ſwellings of the face, and ſometimes worſe ſymptoms than even theſe. The empirical herb-ſnuffs have the leaves of aſarum for their baſis, but ſometimes mixed with ingredients of a more dangerous nature.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Aſphodelus, (*A. fiſtulous*, Lin.)	Aſphodel, or king's ſpear.	The roots.	Emollient and ſuppurative.	
Atriplex (*Chenopodium vulvar.* Lin.)	Stinking orach.	The leaves.	Antiſpaſmodic.	A ſpirituous tincture, decoction, or conſerve, recommended by Tournefort and others.
Avena ſativa (*Lin.*)	Oats.	The grain.	Emollient.	Decoction.
Aura electrica.	Electricity.		A violent ſtimulant	
Aurantium (*Citrus aurant.* Lin.)	The orange.	The leaves, fruit, and flowers.	Cordial, ſtomachic, and refrigerant.	An eſſential oil, a diſtilled water, and a conſerve.
Auricula Judæ, (*Tremell. verruc.* Lin.)	Jews-ears.	The whole.	Purgative, or aſtringent; uncertain.	
Auripigmentum.	Orpiment.		Corroſive, but leſs ſo than arſenic.	
Axungia porcina.	Hog's lard.		Emollient.	
Axungia viperania.	Viper's fat.			
Balauſtia (*Punica granat.* Lin.)	Balauſtine, or double-flowered pomegranate tree.	The flowers.	Aſtringent.	Ingredient in a powder.
Balſamita (*Tanacetum balſaminum*, Lin.)	Coſtmary.	The leaves.	Aromatic, antihyſteric.	Diſtilled water and ſpirituous tincture.
Balſamum Canadenſe (*Pinus balſamea*, Lin.)	Balſam of Canada.	The reſin.	Diuretic and tonic.	
Balſamum Copayvæ (*Copaifera officinalis*, Lin.)	Balſam of Copivi.	The reſin.	Diuretic and tonic.	An empyreumatic oil, and an ingredient in ſome tinctures (E).
Balſamum Gileadenſe (*Amyris Gileadenſis*, Lin.)	Opobalſam, or balm of Gilead.	The reſin.	Said to be a moſt extraordinary vulnerary.	
Balſamum Peruvianum (*Myroxylon peruiferum*, Lin.)	Balſam of Peru.	The reſin.	A fine warm aromatic.	An ingredient in many tinctures, and ſome ointments.
Balſamum Tolutanum (*Toluifera balſamum*, Lin.)	Balſam of Tolu.	The reſin.	Aromatic and corroborant.	An ingredient in ſeveral tinctures, elixirs, and a kind of pectoral pills.
Bardana major, (*Arctium lappa*, Lin.)	Burdock.	The roots and ſeeds.	Aperient, diuretic, and ſudorific.	Decoction.
Barytes (F).				

Beccabunga,

(E) Balſam of Copivi has been employed empirically in hæmorrhoidal caſes; and Dr Cullen informs us, that he has known it give relief in ſuch caſes, in doſes from 20 to 40 drops once or twice a day, mixed with powdered ſugar. Fuller recommends it in conſumptions; but his practice is cenſured by Dr Fothergill in the 4th volume of London Medical Obſervations.

(F) *Barytes.* The ſolution of the aerated barytes, or terra ponderoſa, in ſpirit of ſalt, has been found capable of producing powerful effects on the human ſyſtem. Several trials of it were made in the year 1789 by Dr Crawford, in St Thomas's hoſpital; and it was found to be very efficacious in ſcrophulous complaints.—In ſome caſes of ſwelled glands, foul ulcers, enlarged joints, and general cachexy, ſingular relief was given by the muriated barytes, either alone or joined with mercurials, antimonials, and the bark. The medicine in a few caſes appeared to augment the cuticular ſecretion; in moſt it occaſioned an uncommon flow of urine, and almoſt univerſally improved the appetite and general health of the body. Few ſtomachs, however, could bear more than from ſix to ten drops of a ſaturated ſolution, nor did a continued uſe of the medicine reconcile the ſtomach to it, but rather the contrary. Sometimes it produced a vertigo, which probably aroſe from its nauſeating quality. Dr Crawford is of opinion, that this ſolution, when injudiciouſly managed, is capable of producing deleterious effects, by diſordering the nervous ſyſtem, and bringing on violent vomiting and purging. From ſome experiments made upon dogs, it appears that a large doſe would prove fatal.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Beccabunga (*Veronica beccabunga,* Lin.)	Brooklime.	The herb.	Attenuating, and antiſcorbutic.	
Bechen album, (*Centaurea bechen,* Lin.)		The root.	Stimulant.	
Bechen rubrum, (*Statice limon.* Lin.)		The root.	Stimulant.	
Belladona (*Atropa belladonna,* Lin.)	Deadly night-ſhade.	The juice.	Narcotic.	An extract of the juice, decoction, infuſion, powders.
Bellis minor, (*Bell. peren.* Lin.)	Common daiſy.	The leaves.	Attenuant.	
Benzoë, (*Terminalia benzoin,* Lin.	Benzoin.	The reſin.	Pectoral.	Ingredient in the paregoric elixir.
Berberis (*Berber. vulgar.* Lin.)	Barberry.	The bark and fruit.	Aſtringent.	A jelly.
Beta, *B. vulgaris,* Lin.)	The beet.	The root and leaves	Cathartic and errhine.	
Betonica *B. officinalis,* Lin.)	Betony.	The leaves and flowers.	Corroborant.	
Betula (*B. alba,* Lin.)	The birch-tree.	The bark and ſap.	Antiſcorbutic and diuretic.	
Bezoar	Bezoar-ſtone.		Many virtues falſely aſcribed to it; now found to be only an abſorbent.	
Bilis animalis.	The gall or bile of animals.		Cathartic.	
Biſtorta (*Polygonum biſtorta,* Lin.)	Biſtort or ſnake-wort.	The roots.	Powerfully aſtringent.	An ingredient in a powder.
Boli.	Boles.		Aſtringent and ſlightly abſorbent.	Ingredients in ſeveral powders.
Bonus Henricus, (*Chenopodium bonus Hen.* Lin.)	Engliſh mercury, all-good, or good Henry.	The leaves.	Laxative.	
Borax.	Tincal, or borax.	The whole.	Diuretic and emmenagogue.	An ingredient in a powder, and a ſalt prepared from it. See CHEMISTRY-*Index*.
Branca urſina (*Acanthus mollis,* Lin.)	Bear's breech.	The root.	Emollient.	
Braſſica, (*B. oleracea,* Lin.)	Cabbage.	The leaves.	Refrigerant and laxative.	
Braſſica marina, (*Convolvulus ſoldanella,* Lin.)	Sea-cole-worts, ſoldanella.	The leaves.	A ſtrong cathartic.	Now rejected from practice.
Brucea antidyſenterica. See note (A), *ſupra.*				
Bryonia (*B. alba,* Lin.)	White briony	The root.	Diſcutient and violently cathartic.	
Burſa paſtoris, (*Thlapſi burſa p.* Lin.)	Shepherd's purſe.	The leaves.	Aſtringent, but very doubtful.	
Cacao (*Theobroma cacao,* Lin.)	Chocolate-tree.	The fruit.	Analeptic.	Chocolate.
Cajeput (*Maleleuca leucadendron,* Lin.)	Cajeput.	The fruit.	Stimulant, healing, carminative.	Diſtilled.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Calminaris lapis.	Calamine ſtone.		Deſiccative, healing.	An ingredient in collyria, epulotic cerate, &c.
Calamintha (*Meliſſa calamintha,* Lin.)	Calamint.	The leaves.	Aromatic and ſtimulant.	
Calamus aromaticus (*acorus calamus,* Lin.)	Sweet-flag.	The roots.	Aromatic and ſtomachic.	
Calendula (*C. Officinalis,* Lin.)	Garden marigold.	The flowers.	Attenuating and ſudorific, but very doubtful.	
Calx viva.	Quicklime.		A violent corroſive, and powerful alterant and abſorbent.	A medicated water.
Camphor (*Laurus camphora,* Lin.)	Camphire-tree.	The concreted eſſential oil.	Refrigerant and diaphoretic, ſtimulant, and antiſpaſmodic.	A ſolution in rectified ſpirit, in expreſſed and eſſential oils. Ingredient in many other compoſitions.
Canella alba (Lin.)	White cinnamon.	The bark.	Aromatic and ſtimulating.	An ingredient in ſeveral other tinctures.
Cannabis (*C. ſativa,* Lin.)	Hemp.	The ſeeds.	Aperient and refrigerant, but doubtful.	Decoctions and infuſions.
Cantharis (*Meloe veſicatorius,* Lin.)	Spaniſh fly.		Violently ſtimulating and veſicatory.	A ſpirituous tincture, a plaſter, ointment, &c.
Caparis (*C. ſpinoſa,* Lin.)	Caper-buſh.	The bark of the root, and flower-buds.	Aperient and ſtomachic.	Pickled.
Cardamines (*C. pratenſis,* Lin.)	Cardamine.	The flowers.	Antiſpaſmodic.	Powder.
Cardamomum majus (*Amom. cardam.* Lin.)	Greater cardamom	The ſeeds.	Aromatic and ſtimulant.	A ſpirituous water and tincture. Ingredient alſo in ſeveral officinal compoſitions.
Cardamomum minus (*Amom. repens,* Lin.)	Leſſer cardamon.	The ſeeds.	Aromatic and ſtimulant.	
Cardiaca (*Leonurus cardiaca,* Lin.)	Mother-wort.	The leaves.	Antiſpaſmodic.	
Carduus benedictus (*Centaurea benedicta,* Lin.)	Bleſſed-thiſtle.	The leaves and ſeed.	Stomachic.	An ingredient in a ſtomachic tincture. Infuſions.
Carica (*Ficus carica,* Lin.)	The fig.	The dried fruit.	Emollient, ſuppurative.	Ingredient in the pectoral decoction and lenitive electuary.
Carlina (*C. acaul.* Lin.)	Carline-thiſtle.	The root.	Diaphoretic.	
Carpobalſam (*Amyris Gileadenſis,* Lin.)	Carpobalſam.	The fruit	Aromatic.	In ſubſtance applied warm as a cataplaſm.
Carthamus (*C. tinctorius,* Lin.)	Baſtard ſaffron.	The ſeeds.	Cathartic.	
Carvi (*Carum carvi,* Lin.)	Caraway.	The ſeeds.	Aromatic.	An eſſential oil, a ſpirituous water. Ingredient alſo in ſome officinal compoſitions.
Caryophylla rubra (*Dianthus carioph.* Lin.)	Clove july-flower.	The flowers.	Cardiac and alexipharmac.	A ſyrup.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Caryophyllata, (*Geum urban.* Lin.)	Avens, or herb benet.	The root.	Aromatic.	An eſſential oil.
Caryophyllum (*C. aromaticus,* Lin.)	The clove-tree.	The flower-cups.	Strongly aromatic.	An eſſential oil. Ingredient alſo in many officinal compoſitions.
Caſcarilla (*Croton caſcar,* Lin. *Croton eleutheria,* Swartz Prodr.	Caſcarilla.	The bark.	Aromatic, and ſtimulant.	Infuſions.
Caſſia fiſtularis (*C. fiſtula,* Lin.)	Caſſia.	The fruit.	Purgative.	An ingredient in two electuaries.
Caſſia lignea (*Laurus caſſia,* Lin.)	Caſſia.	The bark and flower-buds.	Aromatic.	The baſis of a diſtilled water.
Caſſumunar.	Caſſumar.	The root.	Stomachic and carminative.	
Caſtoreum (*Caſtor fiber,* Lin.)	Caſtor.		Nervine and antiſpaſmodic.	A ſimple water; a ſpirituous water; a tincture. Ingregredient in ſeveral officinal compoſitions.
Catechu (*Mimoſa catechu,* Lin.)	Catechu, *vulgo* Japan earth.		Aſtringent.	A tincture, troches, and confection, and an ingredient in ſeveral officinal compoſitions.
Celeri (*Apium graveolens,* Lin.)	Celery.	The leaves.	Laxative.	
Centaurium majus (*Centurea centaurium,* Lin.)	Greater centaury.	The root.	Aſtringent, aperient, and vulnerary.	
Centaurium minus (*Gentiana centaur.* Lin.)	Leſſer centaury.	The tops.	Stomachic.	Tincture and infuſion.
Cepa (*Allium cepa,* Lin.)	The onion.	The root.	Attenuating and diuretic.	
Cera alba.	White wax.		Emollient.	Ingredient in many plaſters and ointments.
Cera flava.	Yellow wax.		Emollient.	Ingredient in almoſt all ointments.
Ceraſus (*Prunus ceraſus,* Lin.)	The cherry tree.	The fruit and gum.	Refrigerant; the gum partaking of the properties of gum-arabic.	
Cerefolium (*Sandix, cerefol.* Lin.)	Chervil.	The juice.	Aperient and diuretic.	
Ceterach (*Aſplen. ceterach.* Lin.)	Spleenwort.	The leaves.	Diuretic (G).	
Cevadilla (*Veratum album.* Lin. ?	Indian cauſtic barley.	The ſeeds.	Virulently cauſtic, (H).	
Chamædrys (*Teucrium chamædr.* Lin.)	Germander.	The leaves and tops with the ſeed.	Sudorific, diuretic, &c.	

(G) M. Morant relates, that theſe leaves have lately been diſcovered to have an admirable diuretic virtue; that they were uſed with great ſucceſs by Count d'Auteuil, a Spaniſh naval commander, for the gravel, with which he was violently tormented; and ſince that time they have come greatly into uſe at Paris, Verdun, and Grenoble. From obſervations made in thoſe places it appears, that they carry off ſand, cleanſe the kidneys, and mitigate pains in the urinary paſſages; that the method of uſing them is to drink infuſions of the leaves in the mooning as tea, adding ſuch other medicines as may be judged proper.

(H) Theſe ſeeds appear to be the ſtrongeſt of all vegetable cauſtics. Monardes relates, that in putrid verminous

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Chamæmelum (*Anthemis nobilis* Lin.)	Camomile.	The ſingle flowers	Stomachic, carminative, and emollient.	An eſſential oil, a ſimple water, an extract, a decoction.
Chamæpithys (*Teucrium chamæpit.* Lin.)	Ground-pine.	The leaves.	Aperient and vulnerary.	
Cheiri, ſeu Leucojum luteum (*Cheiranthcheiri*, Lin.)	Wallflower.	The flower.	Aperient, cordial, and attenuant.	
Chæle cancrorum.	Crab's claws.		Abſorbent.	Levigated.
Chelidonium majus, Lin.)	Common celandine	The leaves and roots.	Stimulating, diuretic, & ſudorific	Infuſion. Dried root powdered.
Chelidonium minus (*Ranunculus ficaria*, Lin.)	Pilewort.	The leaves and root.	Emollient.	
China (*Smilax China*, Lin.)	China.	The root.	Diaphoretic and diuretic.	
Cicer (*C. arietin.* Lin.)	Red chices, or chick peas.	The ſeeds.	Lithontriptic and diuretic but very doubtful.	
Cichorium (*C. intyb.* Lin.)	Wild ſuccory.	The roots and leaves.	Laxative and antiſcorbutic.	
Cicuta major (*Conium maculat.* Lin.)	Hemlock (1).	The leaves and ſeeds.	Reſolvent and alterant.	Inſpiſſated juice of the leaves, and an extract from the ſeeds.

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minous ulcers and gangrenes, they have the ſame effects as corroſive ſublimate, or the actual cautery; and that the way of uſing them is to ſprinkle a little of powdered ſeed upon the part; or, for the greater ſafety, to dilute it with watery liquors, and apply lint dipped in the mixture. In the *Amænitates Academicæ* of Linnæus, they are ſaid to be the moſt powerful of all medicines for deſtroying cutaneous inſects in children.

(1) It is ſuppoſed that the juice of this plant was the poiſon ſo much uſed among the Athenians for putting criminals to death; but from ſome late experiments this ſeems to be doubtful; or at leaſt that the remedy is very eaſy. Mr Haram, apothecary at Chartres, informs us, that a large ſpoonful of the juice given to a cat had no ſenſible effect; a ſecond produced a viſible *embarras* on the region of the reins: in a little time the animal ſtaggered, but did not fall. A quarter of an hour after, ſhe was found ſtretched out motionleſs, with her paws rigid. Half a drachm of theriaca, with two large ſpoonfuls of wine, were given without effect: but no ſooner was a large ſpoonful of lemon-juice ſwallowed than ſhe got up as if nothing had happened, and continued afterwards in good health. Our authors likewiſe inform us, that vinegar is an antidote againſt the poiſonous effects of this plant.

With regard to its medical virtues, Dr Monro, who has ſeen it tried in a great number of caſes, informs us that he never ſaw it cure a confirmed cancer, whether ulcerated or not; that in a few caſes of ulcerated cancers it amended the diſcharge, and changed it from a thin ichor to an appearance of laudable pus; but, notwithſtanding this favourable appearance, the diſtemper at laſt terminated fatally.—In ſcrophulous caſes, ſome few ſmall tumours were thought to be diſcuſſed by it; but large hard ſwellings were never removed by it, tho' the remedy was continued for weeks and months. The diſcharge from ſcrophulous ſores of the extremities, however, was often mended by it; and in many caſes, it was found to be of more ſervice when joined with the bark than when given alone: the action of the bark and mercury was thought to be rendered more powerful by it. In the chincough it did not produce any remarkable effects. In ſome few inſtances, he imagined that it hurt the health of the patients; and in one or two, that it haſtened death. In this laſt caſe, indeed, the uſe of the cicuta had been laid aſide for ſome time, and the patients ſunk ſo gradually, that our author was in doubt what might have been the cauſe of their death.

The roots of hemlock have been ſuppoſed to be more active than the leaves, both when taken internally and when outwardly applied. Dr Storck relates, that on being cut, it yields a bitter acrid milk, of which a drop or two applied to the tip of the tongue occaſioned a rigidity, pain, and ſwelling of the part, ſo as to deprive him of the power of ſpeech. Theſe ſymptoms, however, diſappeared on waſhing the part with citron juice. When dried, it loſes its virulence; ſo that Dr Storck ſays, he has taken a grain or two of the powder without injury. Other authors give inſtances where 20 and 30 grains have been given with good effect in ſchirroſities of the liver, quartan agues, on the approach of a fit, and even in acute fevers. Dr Aikin informs us, that the freſh root ſeems not to be at all times of equal virulence; and that he has ſeen it chewed freely

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Cinara (*Cynara ſcolymus*, Lin.)	Artichoke.	The leaves.	Diuretic (K).	
Cinnamomum. *Laurus cinnam.* Lin.)	The cinnamon-tree.	The bark.	Aromatic and corroborant.	An eſſential oil, a ſimple and ſpirituous diſtilled water, and an ingredient in a great number of compoſitions.
Citrullus (*Cucurbita, citrullus*, Lin.)	Citruls.	The ſeeds.	Refrigerant.	
Coccinella (*Coccus cacti*, Lin.)	Cochineal.		Sudorific, but chiefly uſed for colouring.	
Cocculus Indicus, (*Meniſperm. coccul.* Lin.)	Indian berry.	The fruit.	Narcotic.	
Cochlearia (*C. officinalis*, Lin.)	Scurvy-graſs.	The leaves.	Stimulating and attenuant.	A conſerve and ſpirit. An ingredient in ſome other officinal preparations.
Coffea *C. Arabica*, Lin.)	The coffee-tree.	The fruit.	Stomachic and corroborant.	A decoction.
Colchicum (*C. autumnale*, Lin.)	Meadow ſaffron.	The root.	Diuretic.	A ſyrup and oxymel.
Colocynthis (*Cucumis colocynthis*, Lin.)	Coloquintida, or bitter-apple.	The medullary part of the dried fruit.	Violently cathartic.	An ingredient in ſome cathartic pills and extracts.
Columbo (*Ignatia amara*, Lin.)	Columbo, or Colomba.	The root.	A moſt excellent antiſeptic and ſtomachic.	A vinous tincture.
Coneſſi (*Nerium antidyſentericum*, Lin.)	Coneſſi.	The bark.	Antiſeptic and tonic. (L.)	
Conſolida major, (*Symphitum officin.* Lin.)	Comfrey.	The root.	Emollient.	

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without any other effect than that ſweetiſhneſs obſervable in parſley roots or carrots. There are likewiſe inſtances, where the cicuta roots have been taken to the quantity of ſome drachms, or even ounces, without any bad conſequence.

The ſeeds have been recommended as demulcent, paregoric, and antaphrodiſiac; but little more (according to Dr Aikin) is yet known about them, but that they are innocent to ſome birds. Mr Ray ſays, that he found the crop of a thruſh full of them, and that at a ſeaſon when the corn was in full growth.

In the firſt volume of the Medical Commentaries, an extract prepared from hemlock-ſeeds is preferred to that made from the leaves; and in the laſt Edinburgh Pharmacopœia, an extract of this kind is ordered as an officinal.

(K) Dr Aikin informs us, that the expreſſed juice of the leaves has ſometimes proved ſucceſsful in dropſies, when other remedies had failed. For this purpoſe it is not depurated, but only freed by paſſing through a ſtrainer from the groſſer feculencies, and mixed with an equal quantity of white wine; three or four ſpoonfuls to be taken every morning and evening.—The following decoction (as we are informed by Dr Monro) was long kept a ſecret by a perſon at Andover, and is ſaid to have carried off the water from ſeveral people labouring under a dropſy. Take of artichoke leaves and ſtalks three handfuls; of bruiſed juniper-berries one quart; of ſcraped horſe-raddiſh one handful; of green firr-tops two handfuls; of bruiſed white muſtard-ſeed two table-ſpoonfuls; mix the whole, and boil them in two gallons of water to one, and ſtrain the whole thro' a cloth. Half a pint to be taken by a grown perſon morning and evening, adding a little ſyrup or ſugar to make it agreeable.

(L) This bark is reckoned a ſpecific in diarrhœas: the fine powder being made uſe of in an electuary formed with ſyrup of oranges, and given to the quantity of half a drachm or more four times a day, after a vomit has been given. The firſt day it is taken, the number of ſtools is generally increaſed, without any increaſe of the griping; the ſecond, the colour of the ſtools is meliorated; and, on the third or fourth, the conſiſtence approaches to the natural, when it makes a cure. It ſeldom fails in curing a recent diarrhœa, proceeding from irregularities in diet without fever; and it is frequently of ſervice in habitual diarrhœas.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Contrayerva (*Dorſtenia contrayerva*, Lin.)	Contrayerva.	The root.	Aromatic and diaphoretic.	Spirituous tincture, extract, powder.
Convallaria (*C. Polygonatum*, Lin.)	Solomon's ſeal.	The root.	Suppurative.	Poultice, decoction in milk recommended in ſome caſes of hemorrhagy.
Corallina (*Sertularia*, Lin.)	Coralline.		Abſorbent.	
Coriandrum (*C. ſativum*, Lin.)	Coriander.	The ſeeds.	Carminative and ſtomachic.	Formerly an ingredient in ſome officinal compoſitions.
Cornu cervi (*Cervus elephas*, Lin.)	Hartſhorn.		Emollient and nutritious.	Shavings, a jelly, a volatile alkaline ſalt and ſpirit, and an empyreumatic oil.
Coſtus (*C. Arab.* Lin.)	Coſtus.	The root.	Attenuant and diuretic.	
Craſſula (*Sedum telephium*, Lin.)	Leſſe orpine.	The leaves.	Emollient and aſtringent.	
Creta alba.	White Chalk.		Abſorbent.	
Crithmum (*C. maritimum*, Lin.)	Samphire.	The leaves.	Aperient, ſtomachic, and diuretic.	
Crocus (*C. ſativus offic.* Lin.)	Saffron.	The chives, or fleſhy capillaments growing at the end of the flower.	Aromatic and cordial.	A ſpirituous tincture; a ſyrup; and an ingredient in ſeveral officinal compoſitions.
Croton. See *Caſcarilla ſupra.*				
Cubebæ (*Piper cubeba*, Lin.)	Cubebs.	The fruit.	Aromatic and ſtimulant.	An ingredient in ſeveral officinal compoſitions.
Cucumis hortenſis (*C. ſativus*, Lin.)	The garden cucumber.	The ſeeds.	Refrigerant.	
Cucumis agreſtis (*Momordica elaterium*, Lin.)	Wild cucumber.	The fruit.	Violently Cathartic.	The juice inſpiſſated.
Cucurbita (*C. pepo*, Lin.)	The gourd and pompion.	The ſeeds.	Refrigerating.	An expreſſed oil.
Cuminum (*C. cyminum*, Lin.)	Cummin.	The ſeed.	Aromatic, ſtimulant.	An eſſential oil by diſtillation; and giving a name to a plaſter and cataplaſm.
Cupreſſus.	The cypreſs.	The fruit.	A ſtrong aſtringent.	
Cuprum.	Copper.		A violent emetic, diuretic and alterative.	Calcined, and producing ſalts by combination with ſeveral acids, and with volatile alkali. See CHEMISTRY *Index*.
Curcuma (*C. longa*, Lin.)	Turmeric.	The root.	Aromatic, aperient and emmenagogue.	
Curſuta (*Gentiana purpurea*, Lin.)		The root.	Stomachic.	
Cydonium (*Pirus cydonia*, Lin).	The quince.	The fruit and ſeeds	Stomachic and corroborative.	A ſyrup and jelly of the fruit, and mucilage of the ſeeds.
Cyminum. See *Cuminum*, ſupra.				
Cynogloſſus (*C. officinalis*, Lin.)	Hound's tongue.	The root.	Narcotic, but doubtful.	
Cynoſbatum (*Roſa canina*, Lin.)	The wild briar, dog-roſe, or hip-tree.	The fruit and flowers.	Refrigerant and antiſcorbutic.	A diſtilled water and conſerve.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Cyperus (*C. longus,* Lin)	Long cyperus.	The root.	Aromatic and carminative.	
Dactylus (*Phoenix dactylif.* Lin.)	The date-tree.	The fruit.	Emollient and ſlightly aſtringent.	
Daucus Creticus (*Athamanta Cretenſis,* Lin.)	Candy carrot.	The ſeeds.	Aromatic.	Ingredient in mithridate and theriaca.
Daucus ſativus (*D. carota,* Lin.)	The garden carrot.	The roots.	Powerfully antiſeptic.	A poultice from them for cancers, and a marmalade.
Daucus ſilveſtris (*D. carota.* Lin.)	Wild carrot.	The ſeeds.	Aromatic.	
Dens leonis (*Leontodon. tarax.* Lin.)	Dandelion.	The root and herb.	Attenuant, but doubtful.	
Dictamnus Creticus (*Origanum dictamnus,* Lin.)	Dittany of Crete.	The leaves.	Aromatic.	An eſſential oil; and ingredient in ſeveral officinal powders.
Dictamnus albus (Lin.)	Baſtard dittany.	The root.	Alexipharmac, tonic, and anthelmintic.	
Digitalis (*D. purpurea,* Lin.)	Fox-glove.	The leaves.	Emetic, cathartic, and diuretic.	The leaves in powder or infuſion, uſed in dropſies.
Dolichos (*P. pruriens,* Lin.)	Couhage, or cowitch.	The hairy matter of the pods.	Anthelmintic.	
Doronicum. See *Arnica.*				
Dulcamara (*Solanum dulcamara,* Lin.)	Bitter-ſweet, or woody nightſhade.	The herb and root.	Diaphoretic, attenuant, and cathartic.	Watery infuſions.
Ebulus (*Sambucus ebulus,* Lin.)	Dwarf-elder, or Danewort.	The root, bark, leaves, and fruit.	Strongly cathartic.	A rob from the berries.
Elaterium. See *Cucumis.*				
Elatine (*Veronica officinalis,* Lin.)	Fluellin, or female ſpeedwell.	The leaves.	Diuretic and attenuant.	Gives name to one of the officinal honeys.
Elecampane. See *Enula.*				
Elemi (*Amyris elemifera,* Lin.)	Gum elemi.		Aromatic.	Gives name to an ointment.
Eleutheria. See *Caſcarilla.*				
Endivia (*Choreum endivia,* Lin.)	Endive.	The leaves and roots.	Aperient and refrigerant.	
Enula (*Inula helenium,* Lin.)	Elecampane.	The root.	Expectorant, ſtomachic, attenuating, and tonic.	Spirituous and watery extracts. A confection.
Eruca (*Siſymbrium amphibium,* Lin.)	Rocket.	The ſeeds.	Stimulant.	
Eryngium (*E. maritim.* Lin.	Eryngo, or ſea-holly.	The root.	Aperient and diuretic.	
Eryſimum (*E. officinale,* Lin)	Hedge-muſtard.	The recent plant.	Attenuant and diuretic.	
Eupatorium cannabinum, Lin.)	Hemp-agrimony. water-agrimony, or water-hemp.	The leaves.	Attenuant, corroborant, and antiſcorbutic.	
Euphorbium (*Euphorbia officinalis,* Lin.)	Euphorbium.		Sternutatory.	Powder.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Faba Indica, ſeu Sancti Ignatii, (*Ignatia amara*, Lin.)	St Ignatius's bean.	The ſeeds; (the root, the columbo.)	Antiſpaſmodic.	
Faba vicia (*Vicia faba*, Lin.)	The garden-bean.	The ſeeds & flowers.	Nutritive and coſmetic.	A diſtilled water from the flowers.
Fagopyrum (*Polyg. fagopyr.* Lin.)	Snakeweed.	The ſeeds.	Refrigerant	
Farina tritici vel avenæ.	Bran.		Diſcutient.	
Ferrum.	Iron.		Corroborative and alterant.	Infuſions in wine; the metal reduced to a calx by ruſt, or by fire, and ſome ſalts produced from it by combinations with different acids. See CHEMISTRY-*Index*.
Ficus. See *Carica*.				
Filipendula (*Spiræa filipend.* Lin.)	Common dropwort	The root.	Aſtringent and corroborant.	
Filix (*Polypodium filix mas*, Lin.)	The male fern.	The leaves and root.	Anthelmintic and deobſtruent.	Powder.
Flammula Jovis *Clematis flammula*, Lin.)	Upright virgin's-bower.	The leaves and flowers.	Very acrid.	Powder for ſprinkling on cancerous and venereal ulcers; infuſion and extract for internal uſe, in waſtings, &c. from lues venerea.
Fœniculum dulce et vulgare (*Anethum fœnic.* Lin.)	Sweet and common fennel.	The ſeeds, roots, and leaves.	Aromatic ſtimulant, and carminative.	A ſimple water; and an ingredient in one or two compoſitions.
Fœniculum aquaticum (*Phellandrium aquat.* Lin.)	Waterwort.	The leaves and ſeeds.	Corroborant.	
Fœnum Græcum (*Trigonella fœnum-græcum*, Lin.)	Fenugreek.	The ſeeds.	Emollient.	Chiefly uſed in cataplaſms, fomentations, emollient glyſters, &c.
Formica (*F. rufa.* Lin.)	The ant.	The whole inſect.	Stimulant.	An oil and acid ſpirit.
Fragaria (*F. veſca*, Lin.)	The ſtrawberry buſh.	The leaves and fruit.	Aſtringent, corroborant, and refrigerant.	
Frangula (*Alnus nigra*, Lin.)	Black alder.	The bark.	Violently cathartic.	
Fraxinella (*Dictamnus albus*, Lin.)	White or baſtard dittany.	The root.	Diaphoretic.	
Fraxinus (*F. excelſior*, Lin.)	The aſh-tree.	The bark & ſeeds.	Aſtringent and ſtimulant.	
Fuligo ligni ſplendens.	Shining woodſoot.		Antiſpaſmodic.	A ſpirituous tincture.
Fumaria (*F. officinalis*, Lin.)	Fumitory.	The leaves.	Stimulating attenuant, and antiſcorbutic.	
Fungus melitenſis (*Cynomorium coccin.* Lin.)		The ſtems & tops.	Tonic and aſtringent.	Decoction and tincture.
Galanga minor *Kæmpferia Galangal*, Lin.)	Galangal.	The root.	Stomachic.	
Galbanum (*Bubon galbanum*, Lin.)	Galbanum.	The gum.	Antihyſteric.	An ingredient in ſeveral officinal compoſitions.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Galega (*G. Officinalis*, Lin.)	Goat's rue.	The herb.	Diaphoretic. but very doubtful.	
Gallæ *ex querc. cerr.* Lin.)	Galls.		Aſtringent (M.)	
Gallium luteum (*G. verum*, Lin.)	Yellow ladies bedſtraw, or cheeſe-rennet.	The tops.	Aſtringent.	
Gambogia. See *Gummi gambogia*, infra.				
Geniſta (*Spartium ſcoparium*, Lin.)	Broom.	The leaves, flowers and ſeeds.	Diuretic and cathartic.	
Gentiana (*G. lutea*, Lin.)	Common gentian.	The root.	Stomachic and ſtimulant.	A ſpirituous tincture, ingredient in many compoſitions.
Geoffræa (*G. inermis*, Lin.)	Cabbage-bark, or worm-bark tree.	The bark.	Anthelmintic and purgative.	Powder, decoction, ſyrup, extract.
Geranium Robertianum (Lin.)	Herb Robert.	The leaves.	Aſtringent, but very doubtful.	
Ginſeng (*Panax quinquefol.* Lin.)	Ginſeng.	The root.	Stimulant and corroborant.	
Gladiolum luteum (*Iris pſeudacorus*, Lin.)	Yellow water-flag, baſtard acorus, or water flower-de-luce.	The roots.	Strongly cathartic.	
Glycyrrhiza (*G. glabra*, Lin.)	Liquorice.	The root.	Emollient and pectoral.	An extract and powder. An ingredient in many officinal compoſitions.
Gramen caninum (*Triticum repens*, Lin.)	Quick-graſs.	The roots.	Aperient.	
Grana paradiſi (*Amomum gr. par.* Lin.)	Grains of paradiſe.	The ſeeds.	Aromatic and ſtimulant.	
Granatum (*Punica granatum*, Lin.)	The pomegranate.	The fruit and flowers.	Refrigerant and aſtringent.	
Gratiola (*G. officinalis*, Lin.)	Hedge-hyſſop.	The herb.	Emetic and cathartic.	
Guajacum (*G. officinale*, Lin.)	Lignum-vitæ, or guajacum.	The wood and bark.	Aperient, ſtimulant and corroborative.	An extract, two tinctures, and a gummy reſin. An ingredient in many officinal preparations.
Gummi arabicum (*Mimoſa nilotica*, Lin.)	Gum-arabic.		Aſtringent and mucilaginous.	An ingredient in a great number of officinal compoſitions.
Gum ammoniacum (*Ferula meoides*, Lin.)	Gum-ammoniac.		Aperient, antiſpaſmodic, and emollient.	A ſolution. An ingredient in ſeveral pectoral compoſitions.
Gum aſafœtida (*Ferula aſaf.* Lin.)	Aſafœtida.	The concrete juice.	Antihyſteric and anthelmintic.	Tinctures.
Gum bdellium.	Bdellium.		Sudorific, diuretic, and emollient.	
Gum benzoin (*Terminalia benzoin*, Lin. *Styrax benzöe*, Lond. Ph. Tranſ.)	Benzoin.		Coſmetic.	An ingredient in ſeveral anodyne compoſitions.

(M) Dr Cullen informs us, that an ointment compoſed of one part of powdered galls and eight of hogs-lard is a common remedy for the hæmorrhoids, and has been found efficacious.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Gum. elemi (*Amyris elemifera*, Lin.)	Elemi.		Aromatic.	An eſſential oil, and gives name to ointment.
Cum galbanum, (*Bubon galb.* Lin.)	Galbanum.		Antiſpaſmodic.	An ingredient in many antihyſteric medicines.
Gum gambogia (*Gambogia gutta*, Lin. *Stalagmites gambogioides*, Murray)	Gamboge.		Emetic and cathartic.	Gives name to a certain kind of pills.
Gum kino.	Kino.		Aſtringent.	A tincture.
Gum labdanum (*Ciſtus ladanifera*, Lin.)	Labdanum.		Stomachic.	An ingredient in the ſtomachic pills and plaſter.
Gum. lacca (*Coccus lacca*, Lin.) habitans in *Ficu religioſa*, in *Mimoſa cineraria* & aliis.)	Gum lac.		Aſtringent.	A tincture.
Gum. maſtic, (*Piſtachia lentiſcus*, Lin.)	Maſtich.		Corroborant.	
Gum. myrrha.	Myrrh.		Antiſpaſmodic and corroborant.	A tincture, and an ingredient in many officinal compoſitions.
Gummi olibanum, (*Juniperus Lycia*, Lin.)	Olibanum.		Aſtringent but uncertain.	An ingredient in ſome powders, and other officinal compoſitions.
Gummi opoponax (*Paſtinaca opoponax*, Lin.)	Opoponax.		Attenuant and ſtimulant.	An ingredient in ſome officinal compoſitions.
Gum. ſanguis draconis. Vid. *Sanguis*, infra.				
Gum. Senegal (*Mimoſa Seneg.* Lin.)			Aſtringent and mucilaginous.	
Gum. ſtryax. See *Stryax*, infra.				
Gum. thus. See *Thus*, infra.				
Gum. tragacanth (*Aſtragalus, trag.* Lin.)	Gum tragacanth, commonly gum-dragon.		Aſtringent and corroborant.	
Hæmatites.	Blood-ſtone.		Aſtringent and corroborative.	
Hedera arborea (*Hedera helix.* Lin.)	Ivy.	The leaves, berries, and reſin.	Diaphoretic.	
Hedera terreſtris, (*Glechoma hederacea*, Lin.)	Ground-ivy.	The leaves.	Aperient and corroborant.	
Helenium. See *Enula*, ſupra.				
Helleboraſter (*H. fetidus*, Lin.)	Bear's foot.	The leaves.	Emetic, purgative, and anthelmintic.	Syrup.
Helleborus albus, (*Veratrum alb.* Lin.)	White helebore.	The root.	Moſt violently emetic and errhine.	A tincture and honey, formerly.
Helleborus niger Lin.)	Black hellebore, or Melampodium.	The root.	A powerful alterative and emmenagogue.	A tincture and extract.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Hepatica nobilis (*Anemone hepatic.* Lin.)	Noble liverwort.	The leaves.	Cooling and corroborant.	
Hermodactylus, (*Iris tuberoſa*, Lin.)	Hermodactyl.	The root.	Purgative, but doubtful.	
Herniaria (*H. glabra*, Lin.)	Rupture-wort.	The leaves.	Aſtringent	
Hippocaſtanum *Æſcul. hippocaſt.* Lin.)	Horſe-cheſnut.	The bark and fruit	Corroborant and errhine.	
Hordeum (*H. diſtichon*, Lin.)	Barley.		Refrigerant.	A decoction.
Horminum (*Salvia horminum*, Lin.)	Garden-clary.	The leaves and roots.	Corroborative.	
Hydrargyrus. See *Argentum vivum*, ſupra.				
Hydrolapathum (*Rumex aquaticus*, Lin.)	Great water-dock.	The leaves and roots.	Alterant and laxative.	
Hyoſciamus (*H. niger*, Lin).	The common wild or black hen-bane	The leaves and ſeeds.	Narcotic.	Cataplaſm, plaſter, powder, ointment.
Hypericum (*H. perforatum*, Lin.)	St John's wort.	The leaves, flowers, and ſeeds.	Diuretic, ſudorific, and alterant.	Gives name to a coloured oil.
Hypociſtis (*Cytiſus hypociſt.* Lin.)	Hypociſtis.	The juice.	Aſtringent.	Juice inſpiſſated.
Hyſſopus (*H. officinalis*, Lin.)	Hyſſop.	The leaves.	Aromatic and pectoral.	A diſtilled water.
Jalappa (*Convolvulus jalapa*, Lin.)	Jalap.	The root.	Cathartic.	An extract, a ſimple tincture, a compound tincture, a reſin, and powder.
Japonica terra. See *Catechu*, ſupra.				
Imperatoria (*I. oſtruthium*, Lin.)	Maſter-wort.	The root.	Aromatic.	
Indian root. See *Radix Indica*, infra.				
Ipecacoanha (*Pſychotria emetica.* Lin.)	Ipecacuanha.	The root (N.)	Emetic and cathartic.	A vinous tincture, an der.

Iris

(N) A root has been ſometimes imported, under the name of white ipecacuanha (*viola ipecacuanha*, Lin.) which has little or nothing of the virtues of the true kind. More dangerous abuſes, however, have been practiſed by the ſubſtitution or mixture of the roots of a kind of *apocynum*, which have been found to operate with great violence both upwards and downwards, ſo as to prove fatal in ſome caſes. They may however, eaſily be diſtinguiſhed by their colour, which is a deep reddiſh yellow, while the true ipecacuanha is pale coloured or greyiſh: the poiſonous roots are likewiſe larger, the fiſſures more diſtant, and the intermediate ſpaces ſmoother, than in the true ipecacuanha. This root is found to increaſe the purgative virtue of jalap remarkably. Dr Aikin informs us, that 15 grains of jalap, with two or three of ipecacuanha, purge more than twice the quantity of jalap by itſelf.

"Of late (ſays Dr Monro), a notion has prevailed, that the keeping up a nauſea by means of ſmall doſes of ipecacuanha, or of watery ſolution of emetic tartar, was of great ſervice in promoting the cure of fevers, as well as of fluxes, from a belief that they affected the nervous ſyſtem, and were capable of exciting the action of the extreme veſſels, and of increaſing the ſecretions by the ſkin, and of the internal organs. Hitherto I have not found this method to anſwer my expectations; and I have always obſerved, that ſuch a doſe of an emetic as emptied the ſtomach freely, and gave a ſhake to the whole frame, had a much better effect than

thoſe

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Iris Florentina, (*Lin.*)	Florentine oris	The root.	Aromatic and ſtimulant.	An ingredient in ſeveral pectoral medicines.
Iris paluſtris. See *Gladiolum*, ſupra.				
Juglans (*J. regia*, Lin.)	The walnut-tree.	The fruit.	The kernel emollient, the ſhell aſtringent.	
Jujuba, (*Rhamnus zizyph.* Lin.)	Jujubes.	The fruit.	Emollient and balſamic.	
Juncus odoratus. See *Calamus*, ſupra.				
Juniperus (*J. communis*, Lin.)	Juniper.	The berries, wood and reſin.	Carminative and ſtomachic.	An eſſential oil, and ſpirituous water. Ingredient in ſeveral officinal compoſitions.
Kermes (*Coccus querc. ilic.* Lin)	Kermes.		Aſtringent and corroborant.	A confection.
Kino. See *Gum Kino*, ſupra.				
Lac.	Milk.		Analeptic and corroborant.	A ſaccharine ſalt.
Lacca. *See Gum. Lacca*, ſupra.				
Lactuca, (*L. ſativa*, Lin.)	Garden Lettuce.	The leaves and ſeeds.	Suppoſed narcotic.	
Lactuca viroſa, (*Lin.*)	Wild lettuce.	Juice.	Laxative, diuretic, and diaphoretic.	An extract
Ladanum (*Ciſtis creticus*, Lin.)	Ladanum.	The gum-reſin.		Ingredient in the ſtomachic plaſter.
Lamium album (*Lin.*)	White archangel, or dead-nettle.	The leaves and flowers.	Suppoſed corroborant.	
Lavendula (*L. Spica*, Lin.)	Greater, or broad-leaved lavender.	The flower.	An excellent cordial and aromatic.	An eſſential oil, a ſimple and compound ſpirit, and a conſerve. An ingredient in ſome officinal preparations.
Laurus (*L. nobilis*, (Lin.)	The bay-tree.	The leaves and berries.	Carminative and antiſpaſmodic.	An expreſſed oil. An ingredient in different compoſitions.
Lentiſcus (*Piſtacia lentiſcus*, Lin.)	The lentiſe or maſtich tree.	The wood.	Aſtringent, tonic, and diuretic.	
Lepidium, (*L. latifol.* Lin.)	Common broad dittander, pepper wort, or poor man's pepper.	The leaves.	Antiſcorbutic and diuretic.	
Leviſticum (*Liguſticum leviſticum* Lin.)	Lovage.	The root and ſeed.	Aromatic.	Ingredients in ſome compound waters.
Lichen cinereus terreſtris (*L. caninus*, Lin.)	Aſh-coloured ground liverwort.	The whole	Recommended by Dr Mead as a ſpecific againſt the bite of a mad dog, but without foundation.	Principal ingredient in the *pulvis antilyſſus*.
Lichen Iſlandicus (*Lin.*)	Eatable liverwort.	The herb.	Nouriſhing, antiſeptic, and laxative.	

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thoſe frequently repeated ſmall doſes, which kept the patient in a diſagreeable uneaſy ſituation for hours together; and I am perſuaded, that no practitioner of experience, who has attended large hoſpitals, where he has had an opportunity of trying and ſeeing the effects of different medicines, will ever recommend this nauſeating method for general practice in fevers, though it may be of uſe in ſome particular caſes."

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Lignum campechenſe (*Hæmatoxylum campech*. Lin.)	Logwood.	The wood.	Aſtringent.	An extract.
Lignum rhodium, (*Geniſta canarienſis*, Lin.)	Roſewood.	The wood.	Cordial.	An eſſential oil.
Ligaſticum. See *Leveſticum*, ſupra.				
Lilium convallium, (*Conval. maial.* Lin.)	Lilly of the valley.	The root and flowers.	Cephalic and nervine.	
Lilium album, (*L. candidum*, Lin.)	White Lily.	The root.	Emollient.	Poultice.
Limon, (*Citrus medica*, Lin.)	The lemon-tree.	The fruit.	Aromatic, antiſcorbutic, and cordial	An eſſential oil; an ingredient in ſeveral compoſitions.
Linaria (*Antirrhinum linaria*, Lin.)	Toad-flax.	The leaves.	Diuretic and cathartic, but doubtful.	
Lingua cervina, *Aſplenium ſcolopend*. Lin.)	Hart's tongue.	The leaves.	Aperient.	
Linum catharticum (*Euphorbia lathyrus*, Lin.)	Purging flax.	The leaves.	Cathartic.	Infuſion in whey. Dried powder.
Linum Sativum (*L. uſitatiſſimum*, Lin.)	Flax.	The ſeed.	Emollient.	An expreſſed oil. Cataplaſm.
Liquida ambra (*acer negundo*, Lin.)	Sweet gum, or ſtorax tree.	The reſinous juice.	Aromatic and cordial.	
Lithoſpermum (*L. officinale*, Lin.)	Gromwell.	The ſeeds.	Reſolvent; lithontriptic.	
Lobelia (*L. ſiphilitica*, Lin.)	Blue cardinal flower.	The root (o).	Alterant and detergent.	Decoction.
Lujula, or wood-ſorrel. See *Acetoſella*, ſupra.				
Lumbrici et limaces terreſtres.	Earth worms and ſnails.		Aperient and analeptic.	Decoction in milk.
Lupinus (*L. albus*, Lin.)	White lupines.	The ſeeds.	Anthelmintic.	
Lupulus (*Humul. lup*. Lin.)	Hops.	The looſe leafy heads which grow upon the tops of the ſtalks.	Diuretic and ſtomachic.	

Lycoperdon

(o) This root was long a famous ſecret among the North American Indians for curing the veneral diſeaſe. The ſecret was purchaſed by Sir William Johnſon, and has been publiſhed in the writings of Bartram, Kalm, &c. The following method of uſing it is, by Dr Aikin, recommended as the beſt: "A decoction is made of an handful of the roots in three meaſures of water. Of this half a meaſure is taken in the morning faſting, and repeated in the evening; and the doſe is gradually increaſed till its purgative effect becomes too violent, when the medicine is for a time to be intermitted, and then renewed till a perfect cure is effected. One doſe daily is ſufficient during the latter part of the treatment; and the regimen, during the whole proceſs, is to be equally ſtrict with that obſerved in a courſe of mercurial ſalivation. From the third day, the ulcers are to be well waſhed twice daily with the decoction; and it is ſaid, that when they are very deep and foul, the Indians ſprinkle them with powder of the internal bark of the ſpruce tree. By this method we are aſſured that inveterate veneral complaints are cured without the aid of mercury."

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Lycoperdon (*L. boviſta*, Lin.)	Puff ball, or duſty muſhroom.	The whole.	Styptic.	
Macis. See *Nux Moſchata*, infra.				
Majorana (*Origanum majorana*, Lin.)	Sweet marjoram.	The leaves and flowers.	Aromatic and errhine.	An eſſential oil.
Malabathrum (*Laurus caſſia*, Lin.)	Indian leaf.		Aromatic.	An ingredient in mithridate and theriaca.
Malva (*M. ſylveſtris*, Lin.)	The mallow.	The leaves and flowers.	Emollient.	Ingredient in the decoction for glyſters, uſed alſo in cataplaſms and fomentations: formerly there was a conſerve of the flowers.
Malus (*Pyrus malus*, Lin.	The apple-tree.	The fruit.	Refrigerant and laxative.	
Mandragora (*Atropa Mandrag.* Lin.)	The mandrake.	The leaves.	Narcotic.	
Manna (*Fraxinus ornus*, Lin.)	The manna aſh.	The concreted juice.	Laxative.	Gives name to an officinal lohoch, and enters ſeveral other compoſitions.
Marrubium (*M. vulgare*, Lin.)	White horehound.	The leaves.	Stomachic and aperient.	An ingredient in theriaca (P).
Marum Syriacum, (*Teucrium mar.* Lin.)	Syrian herb maſtich.	The leaves.	Aromatic and errhine.	An ingredient in ſome cephalic ſnuffs.
Maſtiche. See *Gum maſtic*, ſupra.				
Matricaria (*M. parthenium*, Lin.)	Feverfew.	The leaves and flowers.	Aperient and antiſpaſmodic.	
Mechoacanna, (*Convolvulus mechoac.* Lin.)	White jalap, or Mechoacan.	The root.	Cathartic.	
Mel.	Honey.		Aperient and detergent.	
Melampodium. See *Helleborus niger*, ſupra.				
Melilotus (*Trifolium melilot.* Lin.)	Melilot.	The leaves and flowers.	Emollient and carminative.	Gives name to a plaſter.
Meliſſa (*M. officin.* Lin.)	Balm.	The leaves.	Aromatic.	An eſſential oil, and an infuſion.
Melo (*Cucumis melo*, Lin.)	The melon.	The ſeeds.	Refrigerant and emollient.	
Mentha criſpa (*Lin.*)	Daniſh or German curled mint.	The herb.	Aromatic and cordial.	A diſtilled water, eſſential oil, and eſſence. An ingredient in ſeveral officinal preparations.
Mentha vulgaris, (*M. viridis*, Lin)	Spearmint.	The herb.	Aromatic and cordial.	A diſtilled water, an eſſential oil, a ſpirit, and eſſence. An ingredient in ſeveral officinal preparations.

(P) The juices of horehound and plantain mixed are remedies of great repute in America againſt the bite of the rattleſnake. They are given by ſpoonfuls at ſhort intervals; while at the ſame time the wounded part is covered with a cataplaſm of the ſame herbs bruiſed. The good effects are ſaid to be ſpeedy, and the recovery of the patient complete and certain.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Mentha piperitus (*M. piperita,* Lin.)	Pepper-mint.	The herb.	Aromatic and cordial.	A diſtilled water, eſſential oil, and eſſence. An ingredient in ſeveral officinal preparations.
Mercurialis (*M. annua,* Lin.)	French mercury.	The leaves.	Emollient and laxative.	A ſyrup.
Meum (*Æthuſa meum,* Lin.)	Spignel.	The root.	Aromatic and carminative.	
Mezereon (*Daphne mezereum,* Lin.)	Mezereon, or ſpurge olive.	The bark of the root.	Violently cathartic.	Decoction and powder.
Millefolium (*Achillea millefol.* Lin.)	Millefoil, or yarrow.	The leaves and flowers.	Mildly aſtringent and aromatic.	An eſſential oil.
Millepedæ (*Oniſcus aſellus,* Lin.)	Wood-lice, hog-lice, or ſlaters.		Diuretic.	The inſects dried and powdered; an infuſion in wine; alſo an ingredient in ſome other officinal preparations.
Minium. See *Plumbum,* infra.				
Morſus diaboli *Scabioſa ſucciſa,* Lin.)	Devil's bit.	The leaves and roots.	Diaphoretic.	
Morus nigra (*Lin.*)	The mulberry-tree	The fruit and bark of the roots.	Refrigerant, aſtringent, and anthelmintic.	A ſyrup from the juice of the fruit.
Moſchus (*M. moſchiferus,* Lin.)	Muſk.		Diaphoretic and antiſpaſmodic.	A julep.
Myriſtica. See *Nux moſchata,* infra.				
Myrobalani (*Prunus myrobalanus,* Lin.	Myrobalans.	The fruit.	Purgative.	
Myrrha. See *Gum myrrha,* ſupra.				
Myrrhia (*Siſon Canadenſe,* Lin.)	Sweet cicely.	The leaves and ſeeds.	Diuretic.	
Myrtillus (*Vaccinium myrtil.* Lin.)	Whortle-berry.	The leaves and berries.	Aſtringent.	
Myrtus (*M. communis,* Lin.)	The myrtle.	The berries.	Aſtringent.	
Napus (*Braſſica napus,* Lin.)	Sweet navew, or navew gentle.	The ſeeds.	Aromatic.	An ingredient in the theriaca.
Nardus Indica, (*Andrapogon nardus,* Lin.)	Indian nard.	The roots.	Stomachic and carminative.	Ingredient in the mithridate and theriaca.
Naſturtium aquaticum (*Siſymbrium naſturtium,* Lin.)	Water-creſſes.	The leaves and juice.	Aperient and antiſcorbutic.	An ingredient in the ſucci ſcorbutici.
Naſturtium hortenſe (*Lepidium ſativum,* Lin.)	Garden creſſes.	The leaves and ſeeds.	Aperient and antiſcorbutic, but much weaker than the former.	
Nepeta (*N. cataria,* Lin.)	Nep, or catmint.	The leaves.	Aromatic and cordial.	
Nephriticum lignum (*Guilandina moringa,* Lin.)	Nephritic wood.	The wood in ſubſtance.	Diuretic, but uncertain.	
Nicotiana (*Nicotiana tabacum,* Lin.)	Tobacco.	The leaves.	Violently emetic, cathartic, and narcotic.	An extract recommended by Stahl and other German phyſicians.

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Nigella (*Nigella ſativa*, Lin.)	Fennel-flower.	The ſeeds.	Aperient and diuretic, butuncertain.	
Nitrum.	Nitre or ſalt-petre.		Diaphoretic, diuretic, and refrigerant.	An acid ſpirit and fixed alkaline ſalt, an aqueous decoction or ſolution, troches. An ingredient in many other officinal preparations.
Nummularia (*Lyſimachia nummularia*, Lin.)	Moneywort, or herb twopence.	The leaves.	Antiſcorbutic.	
Nux moſchata (*Myriſtica aromatica*, Lin. *Myriſtica moſchata*, Act. Holm.)	The nutmeg-tree.	The fruit, and covering called *mace*.	An excellent aromatic, cordial, and ſtomachic.	An expreſſed oil, falſely called *oil of mace*; an eſſential oil; a ſimple water; a ſpirituous water; an ingredient in many officinal compoſitions.
Nux piſtachia (*Piſtachia vera*, Lin.)	Thepiſtachia-tree.	the fruit.	Emollient and analeptic.	
Nux vomica (*Strychnos nux vom.* Lin.)	Nux vomica.	The fruit.	Narcotic.	
Nymphæa alba (*Lin.*)	White water-lily.	The roots and flowers.	Aſtringent and corroborative.	
Ochra	Yellow ochre.		Aſtringent, but very weak.	
Oenanthe (*Oe crocata*, Lin.)	Hemlock dropwort.	Leaves and root.	A virulent poiſon:	But the juice of the root, or the infuſion of the leaf, has been recommended in chronic eruptions. The latter has been alſo found uſeful as an emmenagogue.
Olibanum. See *Gum olibanum*, ſupra.				
Oliva (*Olea Europea* Lin.)	The olive-tree.	The fruit.	Emollient.	An expreſſed oil uſed in almoſt all ointments, plaſters, &c.
Ononis (*G. ſpinoſa*, Lin.)	Reſt-harrow, cammock, or pettywhin.	The root.	Aperient and diuretic.	
Opium (*Papaver, Orientale*, Lin.)	The Aſiatic poppy.	The inſpiſſated juice.	A moſt excellent anodyne and cordial when properly applied, but a very fatal poiſon if taken in too great quantity.	Purified by ſtraining, called the *Thebaic extract*; a vinous and ſpirituous tincture, called *liquid laudanum*. Alſo a capital ingredient in many officinal preparations.
Opopanax. See *Gum opopanax*, ſupra.				
Origanum (*O. vulg.* Lin.)	Wild marjoram.	The leaves.	Aromatic.	An eſſential oil.
Oryza (*O ſativa*, Lin.)	Rice.	The grain.	Emollient and refrigerant.	
Oxylapathum (*Rummex acutus*, Lin.)	Sharp-pointed dock.	The roots and leaves.	Alterant and laxative.	
Pæonia (*P. officinalis*, Lin.)	Male and female peony.	The roots, flowers, and ſeeds.	Emollient and antiſpaſmodic.	Ingredients in ſome anti-epileptic powders.
Palma (*Cocos butyracea*, Lin.)	The palm-tree.	The kernels of the fruit.	Emollient and anodyne.	An expreſſed oil uſed in ſtomachic plaſters.
Palma Chriſti. See *Ricinus*, infra.				

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Papaver album (*P. ſomniferum*, Lin.)	The white poppy.	The heads.	Anodyne.	A ſyrup.
Papaver erraticum (*P. rhœas*, Lin.)	Red poppy, or corn-roſe.	The flowers.	Valued chiefly for the colour they communicate.	A ſyrup.
Paralyſis (*Primula veris offic.* Lin.)	Cowſlip.	The flowers.	Corroborant and antiſpaſmodic.	A ſyrup.
Pareira brava (*Ciſſampelos pareira*, Lin.)	Pareira brava.	The root.	Attenuant, diuretic, and lithontriptic.	
Parietaria (*P. officinalis*, Lin.)	Pellitory of the wall.	The leaves.	Emollient and diuretic.	Ingredient in a nephritic decoction.
Paſtinaca (*P. ſativa*, Lin.)	Garden parſnip.	The roots and ſeeds.	Emollient and aromatic.	
Paſtinaca ſilveſtris Lin.)	Wild parſnip.	The ſeeds.	Aromatic.	
Pentaphyllum (*Potentilla reptans*, Lin.)	Cinquefoil.	The root.	Aſtringent.	
Perſicaria urens (*Polygonum hydropiper*, Lin.)	Bitter arſmart, lake-weed, or water-pepper.	The leaves.	Diuretic and detergent when externally applied.	
Perſicaria mitis (*Polygonum perſic.* Lin.)	Spotted arſmart.	The leaves.	Antiſeptic and aſtringent	
Perſica (*Amygdalus perſica*, Lin.)	The peach-tree.	The leaves, flowers and fruit.	Laxative, anthelmintic, and refrigerant.	
Peruvianus cortex (*Cinchona officiralis*, Lin.)	The quinquina, or Jeſuit's bark-tree.	The bark.	A moſt excellent coroborative.	An extract, a reſin, a ſpirituous tincture, a compound tincture, a tincture in volatile ſpirit; alſo an ingredient in the ſtomachic tincture.
Petaſites (*Tuſſilago petaſites*, Lin.)	Butterbur.	The root.	Aromatic, aperient, and deobſtruent.	
Petroleum.	Rock oil.		Anodyne and corroborative, when applied externally.	
Petroleum Barbadenſe (*Bitumen petroleum*, Lin.)	Barbadoes tar.		Diſcutient, ſudorific, and corroborative.	
Petroſelinum (*Apium petroſelinum*, Lin.)	Common parſley.	The roots, leaves, and ſeeds.	Aperient and ſomewhat aromatic.	The ſeeds an ingredient in an electuary.
Peucedanum (*P. officinalis*, Lin.)	Hog's-fennel, or ſulphur-wort.	The root.	Aperient, ſtimulating, and errhine.	
Pimenta *Myrtus pimenta*, Lin.)	Pimento, Jamaica pepper or all-ſpice.	The berry.	Aromatic and ſtimulant.	The baſis of a diſtilled water, a ſpirit, and an eſſential oil.
Pimpinella ſanguiſorba (*Sanguiſorba officinalis*, Lin.)	The greater wild burnet.	The leaves.	Aſtringent.	
Pimpinella ſaxifraga (*Lin.*)	Burnet ſaxifrage.	The root, leaves and ſeeds.	Diaphoretic, diuretic, and antiſcorbutic.	
Pinus ſylveſtris (*Lin.*	The pine-tree.	The kernels of its fruit or cones, and reſin.	The kernels emollient; for the reſin, ſee *Terebinthina*, infra.	

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Piper longum (*Lin*)	Long pepper.		Highly aromatic and ſtimulant.	
Piper nigrum (*Lin*)	Black pepper.			
Piper Jamaicenſe. See *Pimenta*, ſupra.				
Piper Indicum (*Capſicum annuum*, Lin.)	Guinea pepper.			A powder called *Cayenne pepper*.
Pix liquida (*Pinus ſylveſtris*, Lin.)	Tar.		Attenuant and ſtimulating.	An infuſion in water, and an ingredient in a kind of pectoral pills.
Pix Burgundica (*Pinus abies*, Lin.)	Burgundy pitch.		A warm adheſive reſinous ſubſtance.	Ingredient in ſeveral plaſters, ointments, and cerates.
Plantago latifolia, *P. major*, Lin.)	Common broad-leaved plantine.	The leaves.	Aſtringent.	
Plumbum.	Lead.		Aſtringent and refrigerating, but very dangerous.	Several chemical preparations. See CHEMISTRY.-*Index*. A tincture and extract, or ſolution in vegetable acids; alſo an ingredient in ſeveral ointments, &c.
Polium montanum (*Teucrium polium*, Lin.)	Poley-mountain.	The tops.	Aromatic.	Ingredient in the Mithridate and theriaca.
Polygala amara *Lin.*)	Milkwort.	The root.	Purgative.	
Polygala ſeneka *Lin.*)	Rattleſnake root.	The roots.	Stimulating, attenuant, and diuretic.	
Polypodium (*P. vulgare*, Lin.)	Polypody.	The root.	Laxative.	
Populus nigra, (*Lin.*)	black poplar.	The buds.	Aromatic.	Uſed only in an ointment, but capable of being applied to better purpoſes.
Porrum (*Allium porrum*, Lin.)	The leek.	The root.	A ſtimulating diuretic.	
Portulaca (*P. oleracea*, Lin.)	Purſlane.	The ſeeds.	Refrigerant.	
Primula veris (*Lin.*)	Primroſe.	The herb and root.	Aromatic and ſtomachic.	An infuſion and diſtilled ſpirit.
Prunella (*P. vulgaris*, Lin.)	Self heal.	The leaves.	Attenuant and detergent.	
Pruna Gallica (*Prunus domeſtica*, Lin.)	French or common prunes.	The fruit.	Cooling and aperient.	
Prunus Sylveſtris. See *Acacia Germanica*, ſupra.				
Pſyllium (*Plantago pſyll.* Lin.)	Fleawort.	The ſeeds.	Emollient and laxative.	
Ptarmica (*Achilea ptarmica*, Lin.)	Sneezewort, or baſtard pellitory.	The root.	Errhine and ſtimulating.	
Pulegium (*Mentha puleg.* Lin.)	Pennyroyal.	The flower.	A warm aromatic.	A ſimple water, a ſpirituous water, an eſſential oil; and an ingredient in ſome other officinal compoſitions.
Pulmonaria maculoſa (*P. officinalis*, Lin.)	Spotted lung-wort, or ſage of Jeruſalem.	The leaves.	Said to be aperient and analeptic.	
Pulſatilla nigricans (*Anemone pratenſ.* Lin.)	Meadow anemone.	The herb and flower.	Emetic, diuretic, and cathartic.	An extract and diſtilled water, uſed in venereal complaints and certain diſorders of the eye.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Pyrethrum (*Athemis pyrethr.* Lin.)	Pellitory of Spain.	The root.	Promotes the ſalival flux.	
Quaſſia (*Q. ſimaruba* Lin.)	Simarouba.	The bark.	Antiſeptic; uſeful in dyſentery.	See *Ed. Phil. Tranſ.* vol. ii.
Quaſſia (*Q. amara,* Lin.)	Quaſſy.	The wood.	Stomachic and tonic.	An extract.
Quercus (*Q. robur.* Lin.)	Oak-tree.	The bark.	Strongly aſtringent.	
Quercus marina (*Fucus veſiculoſus,* Lin.)	Sea-wrack or Sea-oak.	The herb.	Aſtringent and detergent.	A powder of the burnt herb.
Radix Indica Lopeziana (*Gaub. Adverſ.*)	Indian or Lopez root.		Aſtringent.	
Raphanus ruſticanus (*Cochleari armoracea,* Lin.)	Horſe-radiſh.	The root.	Stimulating and attenuant.	A compound water.
Rhabarbarum (*Rheum palmat,* Lin.)	Rhubarb.	The root.	Cathartic and ſtomachic.	Toaſted; a watery infuſion: vinous and ſpirituous tinctures; and an ingredient in ſeveral officinal compoſitions.
Rhamnus catharticus. See *Spina cervina,* infra.				
Rhaponticum (*Rhæumrhapon.* Lin.)	Rhapontic.	The roots.	Laxative.	
Rhododendron chryſanthemum (*Lin*).	Rhododendron.	The herb.	Powerfully ſedative.	Decoction and powder; lately found ſerviceable in the gout and rheumatiſm.
Ribes nigrum (*Lin.*)	The black-currant buſh.	The fruit.	Refrigerant and detergent.	A gelly.
Ribes rubrum (*Lin*).	The red-currant buſh.	The fruit.	Ditto.	
Ricinus, (*R. communis,* Lin.)	Palma Chriſti.	The ſeed.	Laxative, anthelmintic.	Expreſſed oil.
Roſa damaſcena (*R. centafolia,* Lin)	Damaſk roſe.	The flower.	Aromatic and gently laxative.	A diſtilled water and ſyrup.
Roſa rubra (*R. Gallica,* Lin.	The red roſe.	The flower.	Aſtringent and corroborative.	A conſerve, honey, tincture, troches, vinegar, and ſyrup. An ingredient in ſeveral officinal compoſitions.
Roſmarinus hortenſis (*R. officinalis* Lin.)	Roſemary.	The tops and flowers.	A fine aromatic and cordial	An eſſential oil; a diſtilled ſpirit called *Hungary water.* An ingredient in many cordial and antiſpaſmodic medicines.
Rubia tinctorum, (*Lin.*)	Madder.	The root.	Aperient and detergent.	
Rubus idæus, (*Lin.*)	The raſp-berry buſh.	The fruit.	Refrigerant.	A ſyrup.
Rubus niger (*R. fruticoſ.* Lin.)	The bramble.	The leaves.	Aſtringent.	
Ruſcus (*R. aculeatus,* Lin.)	Butcher's broom, or knee-holly.	The root.	Aperient.	Ingredient in diet-drinks.
Ruta (*R. graveolens,* Lin.)	Broad-leaved rue.	The leaves and ſeeds.	Powerfully ſtimulating, attenuating, and detergent.	An extract; and an ingredient in ſeveral compoſitions.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Sabadilla. See *Cevadilla*, ſupra.				
Sabina (*Juniperus ſabina*, Lin.)	Savin.	The leaves or tops.	A ſtimulating aperient.	An eſſential oil; a watery extract; and an ingredient in ſeveral officinal compoſitions.
Saccharum (*Arundo ſaccharifera*, Lin.) purificatum & non purificatum.	Sugur, refined and brown.		Emollient and laxative.	
Saccharum cantum, album & rubrum.	Sugar-candy, white and brown.			
Sagapenum (*Ferula orientalis*, Lin.)	Gum ſagapenum.		Aperient and deobſtruent.	An ingredient in ſeveral antiſpaſmodic medicines.
Sal alkali vegetabile.	Vegetable alkaline ſalt, or pearl-aſhes.		Aperient, diuretic, and cauſtic.	The baſis of a great number of neutral ſalts.
Sal alkali minerale.	Mineral alkali, ſalt of Soda, or baſis of ſea-ſalt.		Ditto.	Ditto.
Sal ammoniac. See *Ammoniac*.				
Sal catharticus amarus.	Epſom ſalt.		Cathartic.	Magneſia.
Sal commune.	Common ſalt.		In ſmall doſes ſtimulant, in large ones cathartic.	
Salicaria (*Lythrum Salicar*, Lin.)	Purple looſe-ſtrife.	The herb.	Aſtringent.	
Salix (*S. fragilis*, Lin.)	The crack-willow.	The bark.	Corroborant.	
Salvia (*S. officinalis*, Lin.)	Common ſage.	The leaves.	Moderately ſtimulating and aſtringent.	Infuſions.
Sambucus (*S. nigra*, Lin.)	Common black-berried alder.	The leaves, bark, flowers and berries.	Cathartic, aromatic, and aperient	A rob for internal uſe from the berries, and an ointment and oil from the flowers and bark: the flowers are alſo ingredients in ſome compound waters.
Sanguis draconis, (*Calamus rotang*, *Dracena draco*, *Pterocarpus*, *draco*, &c. Lin.)	Dragon's blood.		Aſtringent.	An ingredient in ſome officinal compoſitions.
Sanicula (*S. Europæa*, Lin.)	Sanicle.	The leaves.	Suppoſed to be corroborant.	
Santalum citrinum, (*S. album*. Lin.)	Yellow ſanders.	The wood.	Greatly recommended by Hoffman as a reſtorative.	Eſſential oil; extract.
Santalum rubrum (*Pterocarpus ſantolinus*, Lin.)	Red ſanders.	The wood.	Uſed only for its colour.	
Santonicum, (*Artemiſia ſantonica* Lin.)	Worm-ſeed.		Anthelmintic.	

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Sapo durus.	Hard Spaniſh ſoap.		Reſolvent and ſtimulating.	The firſt gives name to a plaſter, liniment, balſam, and pills; the ſecond is an ingredient in the milder cauſtic; and the third in an anodyne plaſter.
Sapo mollis.	Common ſoft ſoap.			
Sapo niger.	Black ſoap.			
Saponaria (*S. officinalis*, Lin.)	Soapwort or bruiſewort.	The herb and root.	Aperient corroborant, and ſudorific.	Tincture; extract.
Sarcocolla (*Peanæa ſarcoc.* Lin.)	Gum ſarcocol.		Suppoſed a vulnerary.	Ingredient in the pulvis è ceruſſa.
Sarſaparilla (*Smilax ſarſſap.* Lin.)	Sarſaparilla.	The root.	Alterant, and diaphoretic.	Infuſions and extract.
Saſſafras (*Laurus ſaſafras*, Lin.)	Saſſafras.	The root.	Alterant, aperient, and corroborant.	An eſſential oil; an ingreent in ſome officinal preparations.
Satureia (*S. hortenſis*, Lin.)	Summer ſavory.	The leaves.	A very pungent warm aromatic.	
Satyrion mas (*Orchis maſcula*, Lin.)	Orchis.	The root.	Coagulant and corroborative.	Salep ſuppoſed to be a preparation from a root of this kind.
Saxifraga alba (*S. granulata*, Lin.)	White-flowered ſaxifrage.	The roots and leaves.	Suppoſed to be aperient, diuretic, and lithontrptic, but without juſt foundation.	
Saxifraga vulgaris, (*Peucedanum ſilaus*, Lin.)	Meadow ſaxifrage.	The leaves and ſeeds.		
Scabioſa (*S. arvenſis*, Lin.)	Scabious.	The leaves.	Aperient, ſudorific, and expectorant.	
Scammonium (*Convolvulus ſcam.* Lin.)	Scammony.	Roots.	Srongly cathartic.	Gives name to a powder, and is an ingredient in ſome officinal preparations.
Scilla (*S. maritima*, Lin.)	The ſquill, or ſea-onion.	The root.	Powerfully diuretic, ſtimulant and expectorant.	A ſyrup, vinegar, oxymel, pills; the root dried, baked, and made into troches.
Scolopendrium. See *Lingua cervina*, ſupra.				
Scordium (*Teucrium ſcordium*, Lin.)	Water germander.	The leaves.	Deobſtruent diuretic, and ſudorific, but doubtful.	An ingredient in mithridate, theriaca, and ſeveral other preparations.
Scorzonera (*S. hiſpanica*, Lin.)	Viper's graſs.	The root.	Cordial and ſtimulant, but doubtful.	
Scrophularia (*S. nodoſa*, Lin.)	Fig-wort.	The leaves and root.	Suppoſed corroborant, but doubtful.	
Sebeſten (*Cordia myxa*, Lin.)	Sebeſten plum.		Emollient.	
Sedum acre (Lin.)	Wall ſtone crop, or wall pepper.	The freſh plant.	Strongly purgative, emetic, and diuretic.	
Sedum majus (*S. album*, Lin.)	Greater houſeleek.	The leaves.	Refrigerant.	
Seneka. See *Polygala ſeneka*, ſupra.				
Senna (*Caſſia ſenna*, Lin.)	Senna.	The leaves.	Cathartic.	Infuſion, ſpirituous tinctures, compound powders, and an electuary.

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Serpentaria Virginiana (*Ariſtolochia ſerpentar.* Lin.)	Virginian ſnake-weed.	The root.	A warm diaphoretic and diuretic.	A ſpirituous tincture; and an ingredient in a number of tinctures.
Serpyllum (*Thymus ſerpil,* Lin.)	Mother of thyme.	The herb.	Aromatic.	
Seſelis vulgaris, *Tordilyum officin.* Lin.	Common hartwort.	The ſeeds.	Agreeable aromatics, but neglected. *Lewis.*	
Seſelis maſſilienſis (*Seſeli elatum,* Lin.)	Hartwort of Marſeilles.	The ſeeds.		
Sigillum Salomonis (*Convallaria polygon.* Lin.)	Solomon's ſeal.	The root.	Probably emollient.	
Simarouba. See *Quaſſia ſimarouba,* ſupra.				
Sinapi (*Sinapis alba & nigra,* Lin.)	Muſtard.	The ſeeds, black and white.	Strongly pungent and ſtimulant.	An expreſſed oil.
Sium (*S. nodiflorum,* Lin.)	Creeping ſkerrit, or water parſnip.	The herb.	The juice ſerviceable in ſome cutaneous diſorders.	
Solanum (*S. nigr.* Lin.)	Nightſhade.	The leaves.	Powerfully evacuant.	
Spermaceti (*Phyſeter marcrocephalus,* Lin.)	Spermaceti.		A mild emollient.	Gives name to a lohock.
Spigelia (*S. Marilandica,* Lin.)	Indian pink.	The root.	Anthelmintic.	
Spina cervina, (*Rhamnus catharticus,* Lin.)	Buckthorn.	The berries.	Strongly cathartic.	A ſyrup.
Spiritus vinoſi.	Vinous ſpirits.		Cordial and ſtimulant.	Uſed as menſtruums for tinctures, &c. in almoſt every preparation of that kind.
Spongia (*S. officinal.* Lin.)	Sponge.		Uſed as a tent for dilating ulcers, &c.	Burnt, recommended in ſcrophulous affections.
Stannum.	Tin.		Anthelmintic.	Powdered.
Staphiſagria (*Delphinium ſtaphiſagria,* Lin.)	Staveſacre.	The ſeeds.	A violent cathartic taken internally. Its external application deſtroys lice and other inſects.	
Stoechas (*Lavendula ſtoechas,* Lin.)	Arabian ſtoechas, or French lavender.	The flowers.	Aromatic.	An ingredient in mithridate and theriaca.
Stramonium (*Datura ſtramon.* Lin.)	Thorn-apple.	The herb.	Narcotic,	An extract.
Styrax calamita (*S. officinalis,* Lin.)	Storax.		Aromatic, ſtimulant, and nervine.	Ingredient in ſome tinctures and pills.
Styrax liquida (*Liquidambar ſtyraciflua,* Lin.)	Liquid ſtorax.			Ingredient in a mercurial plaſter.
Suber (*Quercus ſub.* Lin)	The cork-tree.	The bark.	Aſtringent.	

TECHNICAL NAMES.	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Succinum.	Amber.		Aſtringent and corroborant.	A tincture, balſam, eſſential oil, and an ingredient in ſeveral officinal preparations.
Sulphur.	Sulphur, and flowers of ſulphur.		Laxative, diaphoretic, and alterant.	Solutions in different kinds of oils called *balſams*, and an ingredient in ſome ointments.
Sumach (*Rhus coriaria*, Lin.)	Common ſumach.	The leaves and ſeeds.	Aſtringent.	
Tacamahac (*Populus balſamifera*, Lin.)	Tacamahac-tree.	The reſin.	Diſcutient, emollient, and ſuppurative.	An ingredient in ſeveral plaſters.
Tamarindus (*T. Indica*, Lin.)	Tamarinds.	The fruit.	Refrigerant and laxative.	Ingredients in ſome laxative electuaries.
Tamariſcus (*Tamarix Gallica*, Lin.)	The tamariſk-tree.	The leaves and bark.	Aſtringent.	
Tanacetum (*T. vulgare*, Lin.)	Tanſy.	The leaves, flowers, and ſeeds.	Stimulating, antiſpaſmodic, and anthelmintic.	
Taraxacum (*Leontodon tarax.* Lin.)	Dandelion.	The leaves and root.	Attenuating and reſolvent.	A diſtilled ſpirit, recommended by profeſſor Delias of England in aſthmatic and hydropic affections.
Tartarum.	Tartar.		Refrigerant and cathartic.	Purified from its earthy parts, and called *cream of tartar*, the baſis of ſome uſeful purging ſalts. An alkali is alſo prepared from it by fire.
Terebinthina Veneta (*Pinus larix*, Lin.)	Venice turpentine.		Warm ſtimulating diuretics and aperients.	
Terebintha Argentoratenſis.	Straſburgh turpentine.			
Terebinthina Chia.	Chian, or Cyprus turpentine.			
Terebinthina communis.	Common turpentine.		Uſed chiefly in external applications.	An eſſential oil. The reſiduum forms the *reſina alba & nigra*, or white and black roſin of the ſhops, uſed in almoſt every ointment.
Terra Japonica. See *Catechu*, ſupra.				
Thapſus barbatus (*Verpaſcum thapſus*, Lin.)	Great white mullein.	The leaves and flowers.	Analeptic.	A ſpirituous extract from the flowers.
Thea bohea et viridis (*Lin.*)	Bohea and green tea.	The leaves.	Cordial, diuretic, and diaphoretic.	An infuſion.
Thlaſpi (*T. arvenſe*. Lin.)	Treacle, or mithridate muſtard.	The ſeeds.	aromatic and ſtimulant.	Ingredient in theriaca.
Thus vulgare.	Common frankincenſe.		Suppoſed corroborative.	Ingredient in ſome warm plaſters.
Thymus citratus.	Lemon thyme.	The leaves.	An agreeable aromatic.	A diſtilled water and eſſential oil.
Thymus vulgaris.	Common thyme.	The leaves.	An agreeable aromatic.	A diſtilled water and eſſential oil.
Tilia (*T. Europæa*, Lin).	The lime or linden tree.	The flowers.	Antiſpaſmodic.	Infuſion.
Tithymalus (*Euphorbia lathyrus*, Lin.)	The ſpurge.	The juice of the root.	Violently cathartic.	

TECHNICAL NAMES	ENGLISH NAMES.	PARTS USED IN MEDICINE.	VIRTUES.	PREPARATIONS FROM THEM.
Tormentilla (*T. erecta*, Lin.)	Tormentil, or ſeptfoil.	The root.	Aſtringent.	An ingredient in ſeveral officinal compoſitions.
Trichomanes (*Aſplenium trich.* Lin.)	Maidenhair.	The herb.	Pectoral.	Decoction and ſyrup.
Trifolium paludoſum (*Menyanthes trifoliata*, Lin.)	Marſh trefoil, or buck bean.	The leaves.	Laxative and alterant.	
Triticum (*T. hybernum*, Lin.)	Wheat.	The grain and flour.	Nutritive and glutinous.	Starch.
Turpethum (*Convolvulus turpethum*, Lin.)	Turbith.	The root.	Violently cathartic	An extract.
Tuſſilago (*T. farfara*, Lin.)	Coltsfoot.	The leaves and flowers.	Emollient and mucilaginous.	An ingredient in pectoral decoctions.
Tutia.	Tutty.		Ophthalmic.	Ingredient in ſeveral ointments, and collyria.
Valeriana ſylveſtris (*Val. officinalis*, Lin.)	Wild valerian.	The root.	Antiſpaſmodic.	A tincture in proof ſpirit, and in volatile ſpirit; alſo an ingredient in ſeveral cephalic and anti-epileptic medicines.
Voratum. See *Helleborus albus*, ſupra.				
Verbaſcum. See *Thapſus*, ſupra.				
Veronica mas (*V. officinalis*, Lin.)	Male ſpeedwell.	The leaves.	Aperient and pectoral.	Infuſions.
Vinum.	Wine.		Cordial and corroborant.	A menſtruum from a great number of medicinal ſubſtances.
Viola (*V. odorat.* Lin.)	The ſingle March violet.	The flowers.	Laxative.	A ſyrup.
Vipera (*Coluber berus*, Lin.)	The viper.	The fleſh and fat.	Reſtorative and emollient.	A vinous tincture; an ingredient in theriaca.
Vitis vinifera, (*Lin.*)	The vine.	The leaves, ſap, flowers, and fruit.	Aſtringent, diuretic, aromatic, and pectoral.	Wine. The dried fruit or raiſins are ingredients in ſome pectoral and ſtomachic medicines.
Ulmas (*U. campeſtris*, Lin.)	The elm-tree.	The inner bark.	Aſtringent.	A decoction recommended by Dr Letſom in obſtinate cutaneous eruptions.
Winteranus cortex (*Wintera aromatica*, Lin.)	Winter's bark.		Aromatic.	
Urtica (*U. dioica*, Lin.)	The nettle.	The herb.	Rubefacient.	
Uva urſi (*Arbutus uva urſi*, Lin.)	Whortle-berry.	The leaves.	Aſtringent and lithontriptic.	
Zedoaria (*Kæmpferia rotunda*, Lin.)	Zedoary.	The root.	Stomachic and corrobant.	An extract with proof-ſpirit.
Zincum.	Zinc.		Suppoſed to be a good antiepileptic.	The metal reduced to a calx by fire. Calamine and tutty are a kind of ores of this metal. Theſe laſt are the baſis of two officinal ointments. A ſalt produced by its combination with the vitrioic acid. See CHEMISTRY-*Index*.
Zinziber (*Amomum zinzib.* Lin.)	Ginger.	The root.	Aromatic.	A ſyrup. Alſo an ingredient in ſeveral officinal compoſitions.

General TITLES *including ſeveral* SIMPLES.

The five opening roots:	Smallage, Aſparagus, Fennel. Parſley, Butchers broom.
The five emollient herbs:	Marſhmallows, Mallows, Mercury, Pellitory of the wall, Violets.
The four cordial flowers:	Borage, Bugloſs, Roſes, Violets.
The four greater hot ſeeds:	Aniſe, Caraway, Cummin, Fennel.
The four leſſer hot ſeeds:	Biſhopſeed, Stone parſley, Smallage, Wild carrot.
The four greater cold ſeeds:	Water melons, Cucumbers, Gourds, Melons.
The four leſſer cold ſeeds:	Succory, Endive, Lettuce, Purſlane.
The four capillary herbs:	Maidenhair, Engliſh maidenhair. Wall rue. Ceterach.
The 4 carminative flowers:	Camomile, Feverfew, Dill, Melilot.

The ſimples of each of the above claſſes have been often employed together under the reſpective general appellations. This practice has entirely ceaſed amongſt us; and accordingly theſe denominations are now expunged both from the London and Edinburgh pharmacopœias, and they are now retained in very few of the foreign ones. But as theſe articles are frequently mentioned under their general titles by writers of eminence, it was imagined that the above enumeration of them might be of ſome uſe.

GENERAL RULES *for the Collection and Preſervation of* SIMPLES.

ROOTS.

Annual roots are to be taken up before they ſhoot out ſtalks or flowers: Biennial ones, chiefly in the autumn of the ſame year in which the ſeeds were ſown; The perennial, when the leaves fall off, and therefore generally in the autumn. Being waſhed clean from dirt, and freed from the rotten and decayed fibres, they are to be hung up in a warm, ſhady, airy place, till ſufficiently dried. The thicker roots require to be ſlit longitudinally, or cut tranſverſely into thin ſlices. Such roots as loſe their virtues by exſiccation, or are deſired to be preſerved in freſh ſtate, for the greater conveniency of their uſe in certain forms, are to be kept buried in dry ſand.

There are two ſeaſons in which the bennial and perennial roots are reckoned the moſt vigorous, the autumn and ſpring; or rather the time when the ſtalks or leaves have fallen off, and that in which the vegetation is juſt to begin again, or ſoon after it has begun; which times are found to differ conſiderably in different plants.

The college of Edinburgh, in the two firſt editions of their pharmacopœia, directed them to be dug in the ſpring, after the leaves were formed; in the third edition the autumn was preferred. The generality of roots appear, indeed, to be moſt efficacious in the ſpring: but as at this time they are alſo the moſt juicy, and conſequently ſhrivel much in drying, and are rather more difficultly preſerved, it is commonly thought moſt adviſable to take them up in autumn. No rule, however, can be given, that ſhall obtain univerſally: arum root is taken even in the middle of ſummer, without ſuſpicion of its being leſs active than at other ſeaſons: while angelica root is inert during the ſummer, in compariſon of what it was in the autumn, ſpring, or winter.

HERBS and LEAVES.

Herbs are to be gathered when the leaves have come to their full growth, before the flowers unfold; but of ſome plants the flowery tops are preferred. They are to be dried in the ſame manner as roots.

For the gathering of leaves, there cannot perhaps be any univerſal rule any more than for roots; for though moſt herbs appear to be in their greateſt vigour about the time of their flowering, or a little before, there are ſome in which the medicinal parts are more abundant at an earlier period.

Thus mallow and marſhmallow leaves are moſt mucilaginous when young, and by the time of flowering approach more to a woody nature. A difference of the ſame kind is more remarkable in the leaves of certain trees and ſhrubs: the young buds, or rudiments of the leaves, of the black popular tree, have a ſtrong fragrant ſmall, approaching to that of ſtorax; but by the time that the leaves have come to their full growth, their fragrance is exhauſted.

Herbs are directed by moſt of the pharmaceutic writers to be dried in the ſhade; a rule which appears to be very juſt, though it has ſometimes been miſunderſtood. They are not to be excluded from the ſun's *heat*, but from the ſtrong action of the ſolar *light*; by which laſt their colours are more liable to be altered or deſtroyed than thoſe of roots. Slow drying of them in a cool place is far from being of any advantage: both their colours and virtues are preſerved in greateſt

Collection, &c. of Simples.

perfection when they are dried haſtily by the heat of common fire as great as that which the ſun can impart: the juicy ones, in particular, require to be dried by heat, being otherwiſe ſubject to turn black. Odoriferous herbs, dried by fire till they become friable, diſcover indeed, in this arid ſtate, very little ſmell; not that the odorous matter is diſſipated, but on account of its not being communicated from the perfectly dry ſubject to dry air; for as ſoon as a watery vehicle is ſupplied, whether by infuſing the plant in water, or by expoſing it for a little time to a moiſt air, the odorous parts begin to be extracted by virtue of the aqueous moiſture, and diſcover themſelves in their full force.

Of the uſe of heat in the drying of plants, we have an inſtance in the treatment of tea among the Chineſe. According to the accounts of travellers, the leaves, as ſoon as gathered, are brought into an apartment furniſhed with a number of little furnaces or ſtoves, each of which is covered with a clean ſmooth iron plate; the leaves are ſpread on the plates, and kept rolling with the hands till they begin to curl up about the edges; they are then immediately ſwept off on tables, on which one perſon continues to roll them, while another fans them that they may cool haſtily: this proceſs is repeated two or three times, or oftener according as the leaves are diſpoſed to unbend on ſtanding.

Exsiccation of Herbs and Flowers.

Herbs and flowers are to be dried by the gentle heat of a ſtove or common fire, and only in that quantity at a time by which the exſiccation may be very ſoon finiſhed. By this means the ſtrength is beſt preſerved; and this is indicated in proportion as they retain their native colour.

But the leaves of hemlock, and ſome other herbs replete with a ſubtile volatile matter, are to be powdered immediately after the exſiccation, and preſerved in glaſs veſſels, well ſhut.

Flowers.

Flowers are to be gathered when moderately expanded, on a clear dry day, before noon. Red roſes are taken before they open, and the white heels clipped off and thrown away.

The quick drying above recommended for the leaves of plants, is more particularly proper for flowers; in moſt of which both the colour and ſmell are more periſhable than in leaves, and more ſubject to be impaired by ſlow exſiccations. Of the flowers which come freſh into the apothecaries hands, the only ones employed dry in the London pharmacopœia are red roſes; and theſe, in all the compoſitions in which they are uſed in a dry ſtate, are expreſsly ordered to be dried haſtily. One of the moſt valuable aromatics of European growth, ſaffron, is part of a flower, dried on paper on a kind of kiln, with a heat ſufficient to make it ſweat, taking care only not to endanger the ſcorching of it.

It may here be obſerved, that the virtues of flowers are confined to different parts of the flower in different plants. Saffron is a ſingular production growing at the end of the ſtyle or piſtil. The active part of camomile flowers is the yellow diſk, or button in the middle: that of lilies, roſes, clove-july-flowers, violets, and many others, the petala or flower-leaves; while roſemary has little virtue in any of theſe parts, the fragrance admired in the flowers of this plant reſiding chiefly in the cups.

Collection, &c. of Simples.

Seeds and Fruits.

Seeds ſhould be collected when ripe, and beginning to grow dry, before they fall off ſpontaneouſly. Fruits are alſo to be gathered when ripe, unleſs otherwiſe ordered.

Of the fruits whoſe collection comes under the notice of the apothecary, there are few which are uſed in an unripe ſtate; the principal is the ſloe, whoſe virtue as a mild aſtringent is much diminiſhed by maturation. The fruit of the orange tree, raiſed in our gardens or green-houſes, is ſometimes gathered in a ſtate of much greater immaturity, ſoon after it is formed on the tree, before it has acquired its acid juice; at this time it proves an elegant aromatic bitter, nearly reſembling what are called *Curoſſoa oranges*, which appear to be no other than the ſame fruit gathered at the ſame period in a warmer climate.

The rule for collecting ſeeds is more general than any of the others, all the officinal ſeeds being in their greateſt perfection at the time of their maturity. As ſeeds contain little watery moiſture, they require no other warmth for drying them than that of the temperate air in autumn: ſuch as abound with a groſs expreſſible oil, as thoſe commonly called the *cold ſeeds*, ſhould never be expoſed to any conſiderable heat; for this would haſten the rancidity, which, however carefully kept, they are very liable to contract. Seeds are beſt preſerved in their natural huſks or coverings, which ſhould be ſeparated only at the time of uſing; the huſk, or cortical part, ſerving to defend the ſeed from being injured by the air.

Woods and Barks.

The moſt proper ſeaſon for the felling of woods, or ſhaving off their barks, is generally the winter.

No woods of their own growth are now retained by the London or Edinburgh colleges. The only two which had formerly a place in the catalogues of ſimples were the juniper and the box; the firſt of which is never kept in the ſhops, or employed in practice; the other may be procured from the turner; and it is indifferent at what ſeaſon it has been cut down, being at all times ſufficiently fit for the only uſe to which it was applied, the yielding an empyreumatic oil by diſtillation in a ſtrong fire.

It may be doubted, whether barks are not generally more replete with medicinal matter in ſummer and ſpring than in winter. The barks of many trees are in ſummer ſo much loaded with reſin and gum as to burſt ſpontaneouſly, and diſcharge the redundant quantity. It is ſaid that the bark of the oak anſwers beſt for the tanners at the time of the riſing of the ſap in ſpring; and as its uſe in tanning depends on the ſame aſtringent quality for which it is uſed in medicine, it ſhould ſeem to be alſo fitteſt for medicinal purpoſes in the ſpring. It may be obſerved likewiſe, that it is in this laſt ſeaſon that barks in general are moſt conveniently peeled off.

ANIMAL SUBSTANCES.

Animal ſubſtances are to be choſen in their moſt perfect ſtate, unleſs they be ordered otherwiſe.

Whatever virtues theſe bodies may have, they are ſuppoſed to be beſt when they have attained to their common full growth.

MATERIAL, denotes ſomething compoſed of *matter*. In which ſenſe the word ſtands oppoſed to *immaterial*. See MATTER and METAPHYSICS.

MATERIALISTS, a ſect in the ancient church, compoſed of perſons who, being prepoſſeſſed with that maxim in the ancient philoſophy, *Ex nihilo nihil fit*, "Out of nothing nothing can ariſe," had recourſe to an internal matter, on which they ſuppoſed God wrought in the creation; inſtead of admitting God alone as the ſole cauſe of the exiſtence of all things. Tertullian vigorouſly oppoſes the doctrine of the materialiſts in his treatiſe againſt Hermogenes, who was one of their number.

Materialiſts is alſo a name given to thoſe who maintain that the ſoul of man is material; or that the principle of perception and thought is not a ſubſtance diſtinct from the body, but the reſult of corporeal organization: See METAPHYSICS. There are others, called by this name, who have maintained that there is nothing but matter in the univerſe; and that the Deity himſelf is material. See SPINOSISM.

MALHAM, (Jaques), an engraver of conſiderable eminence, was born at Haerlem in 1571, and after the death of his father, Henry Goltzius, a celebrated painter and engraver, married his mother. From his father-in-law he learned the art of engraving. He went to Italy, to complete his ſtudies from the works of the greateſt maſters; and in that country he engraved a conſiderable number of plates. At his return, he worked under the eye of Goltzius, and produced many very valuable prints. Following the example of his father-in-law, he worked entirely with the graver, in a clear, free ſtyle; and though he never equalled him in point of taſte or correctneſs of drawing, eſpecially when confined to the naked parts of the human figure, moſt of his prints are greatly eſteemed.

MATHEMATICS, the ſcience of quantity; or a ſcience that conſiders magnitudes either as computable or meaſurable.

The word in its original, μαθησις, ſignifies *diſcipline*, or *ſcience* in the general; and ſeems to have been applied to the doctrine of quantity, either by way of eminence, or becauſe, this having the ſtart of all other ſciences, the reſt took their common name therefrom. See SCIENCE.

For the origin of the Mathematics, Joſephus dates it before the flood, and makes the ſons of Seth obſervers of the courſe and order of the heavenly bodies; he adds, that, to perpetuate their diſcoveries, and ſecure them from the injuries either of a deluge or a conflagration, they had them engraven on two pillars, the one of ſtone, the other of brick; the former of which he ſays was ſtanding in Syria in his days. See ASTRONOMY.

The firſt who cultivated mathematics after the flood were the Aſſyrians and Chaldeans; from whom, the ſame Joſephus adds, they were carried by Abraham to the Egyptians; who proved ſuch notable proficients, that Ariſtotle makes no ſcruple to fix the firſt riſe of mathematics among them. From Egypt, 584 years before Chriſt, they paſſed into Greece through the hands of Thales, who having learned geometry of the Egyptian prieſts, taught it in his own country. After Thales, comes Pythagoras; who, among other mathematical arts, paid a particular regard to arithmatic; fetching the greateſt part of his philoſophy from numbers; he was the firſt, as Laertius tells us, who abſtracted geometry from matter; and to him we owe the doctrine of incommenſurable magnitude, and the five regular bodies, beſides the firſt principles of muſic and aſtronomy. Pythagoras was ſeconded by Anaxagoras, Œnopides, Briſo, Antipho, and Hippocrates of Scio; who all applied themſelves particularly to the quadrature of the circle, the duplicature of the cube, &c. but the laſt with moſt ſucceſs; this laſt is alſo mentioned by Proclus, as the firſt who compiled elements of mathematics.

Democritus excelled in mathematics as well as phyſics; though none of his works in either kind are extant, the deſtruction of which ſome authors lay at Ariſtotle's door. The next in order is Plato, who not only improved geometry, but introduced it into phyſics, and ſo laid the foundation of a ſolid philoſophy. Out of his ſchool proceeded a crowd of mathematicians. Proclus mentions 13 of note; among whom was Leodamus, who improved the analyſis firſt invented by Plato: Theætetus, who wrote elements; and Archiates, who has the credit of being the firſt who applied mathematics to uſe in life. Theſe were ſucceeded by Neocles and Theon, the laſt of whom contributed to the elements. Eudoxus excelled in arithmetic and geometry, and was the firſt founder of a ſyſtem of aſtronomy. Menechmus invented the conic ſections, and Theudius and Hermotimus improved the elements.

For Ariſtotle, his works are ſo ſtored with mathematics, that Blancanus compiled a whole book of them: out of his ſchool came Eudemus and Theophraſtus; the firſt of whom wrote of numbers, geometry, and inviſible lines; the latter, a mathematical hiſtory. To Ariſteus, Iſidorus, and Hypſicles, we owe the books of ſolids; which, with the other books of elements, were improved, collected, and methodiſed by Euclid, who died 284 years before Chriſt.

An hundred years after Euclid, came Eratoſthenes and Archimedes. Cotemporary with the latter was Conon, a geometrician and aſtronomer. Soon after came Apollonius Pergæus: whoſe conics are ſtill extant. To him are likewiſe aſcribed the 14th and 15th books of Euclid, which are ſaid to have been contracted by Hypſicles. Hipparchus and Menelaus wrote the ſubtenſes in a circle, the latter alſo on ſpherical triangles: Theodoſius's three books of ſpherics are ſtill extant. And all theſe, Menelaus excepted, lived before Chriſt.

A. D. 70. Ptolemy of Alexandria was born; the prince of aſtronomers, and no mean geometrician: he was ſucceeded by the philoſopher Plutarch, of whom we have ſtill extant ſome methematical problems. After him came Eutocius, who commented on Archimedes, and occaſionally mentions the inventions of Philo, Diocles, Nicomedes, Sporus, and Heron, on the duplicature of the cube. To Cteſebes of Alexandria we owe our pumps; and Geminus, who came ſoon after, is preferred by Proclus to Euclid himſelf.

Diophantus of Alexandria was a great maſter of numbers, and the firſt inventor of algebra: among others of the ancients, Nichomachus is celebrated for his arithmetical, geometrical, and muſical works; Serenus, for his books on the ſections of the cylinder; Proclus, for his comments on Euclid; and Theon has the credit, among ſome, of being author of the books of elements aſcribed to Euclid. The laſt to be named among the ancients, is Pappus of Alexandria, who flouriſhed A. D. 400, and is celebrated for his books of mathematical collections ſtill extant.

Mathematics are commonly diſtinguiſhed into *pure and ſpeculative*, which conſider quantity abſtractedly; and *mixed*, which treat of magnitude as ſubſiſting in material bodies, and conſequently are interwoven every where with phyſical conſiderations.

Mixed mathematics are very comprehenſive; ſince to them may be referred aſtronomy, optics, geography, hydroſtatics, mechanics, fortification, navigation, &c. See the articles ASTRONOMY, OPTICS, &c.

Pure mathematics have one peculiar advantage, that they occaſion no diſputes among wrangling diſputants, as in other branches of knowledge; and the reaſon is, becauſe the definitions of the terms are premiſed, and every body that reads a propoſition has the ſame idea of every part of it. Hence it is eaſy to put an end to all mathematical controverſies, by ſhowing, either that our adverſary has not ſtuck to his definitions, or has not laid down true premiſſes, or elſe that he has drawn falſe concluſions from true principles; and in caſe we are able to do neither of theſe, we muſt acknowledge the truth of what he has proved.

It is true, that in mixed mathematics, where we reaſon mathematically upon phyſical ſubjects, we cannot give ſuch juſt definitions as the geometricians: we muſt therefore reſt content with deſcriptions; and they will be of the ſame uſe as definitions, provided we are conſiſtent with ourſelves, and always mean the ſame thing by thoſe terms we have once explained.

Dr Barrow gives a moſt elegant deſcription of the excellence and uſefulneſs of mathematical knowledge, in his inaugural oration, upon being appointed profeſſor of mathematics at Cambridge.

The mathematics, he obſerves, effectually exerciſe, not vainly delude, nor vexatiouſly torment, ſtudious minds with obſcure ſubtilties; but plainly demonſtrate every thing within their reach, draw certain concluſions, inſtruct by profitable rules, and unfold pleaſant queſtions. Theſe diſciplines likewiſe enure and corroborate the mind to a conſtant diligence in ſtudy; they wholly deliver us from a credulous ſimplicity, moſt ſtrongly fortify us againſt the vanity of ſcepticiſm, effectually reſtrain us from a raſh preſumption, moſt eaſily incline us to a due aſſent, and perfectly ſubject us to the government of right reaſon. While the mind is abſtracted and elevated from ſenſible matter, diſtinctly views pure forms, conceives the beauty of ideas, and inveſtigates the harmony of proportions; the manners themſelves are ſenſibly corrected and improved, the affections compoſed and rectified, the fancy calmed and ſettled, and the underſtanding raiſed and excited to more divine contemplations.

MATHEMATICAL, any thing belonging to the ſcience of mathematics.

Mathematical inſtruments, ſuch inſtruments as are uſually employed by mathematicians, as compaſſes, ſcales, quadrants, &c.

Machine for dividing MATHEMATICAL *Inſtruments*. See RAMSDEN'S *Machine*.

MATHER (Dr Cotton), an eminent American divine, born at Boſton in New England in the year 1663. He was educated in Harvard college, and in 1684 became miniſter of Boſton; in the diligent diſcharge of which office he ſpent his life, and promoted ſeveral excellent ſocieties for the public good: particularly one for ſuppreſſing diſorders, one for reforming manners, and a ſociety of peace-makers, whoſe profeſſed buſineſs it was to compoſe differences and prevent law-ſuits. His reputation was not confined to his own country: for in 1710, the univerſity of Glaſgow ſent him a diploma for the degree of doctor in divinity; and, in 1714, the Royal Society of London chooſe him one of their fellows. He died in 1728; and is ſaid to have publiſhed in his life-time 382 pieces, including ſingle ſermons, eſſays, &c. yet ſeveral were of a larger ſize, among which was *Magnalia Chriſti Americana*, or an Eccleſiaſtical Hiſtory of New-England, from its firſt planting in 1620 to 1698, folio. But the moſt remarkable of all his works was that in which, like Glanville, he defended the doctrine of witchcraft. We ſhall content ourſelves with giving the title at large, which is as follows: "The wonders of the inviſible world; being an account of the trials of ſeveral witches lately executed in New-England, and of ſeveral remarkable curioſities therein occurring. Together with, 1. Obſervations on the nature, the number, and the operations of the devils. 2. A ſhort narrative of a late outrage committed by a knot of witches in Swedeland; very much reſembling, and ſo far explaining that under which New-England has laboured. 3. Some counſels directing a due improvement of the terrible things lately done by the unuſual and amazing range of evil ſpirits in New-England. 4. A brief diſcourſe upon the temptations which are the more ordinary devices of Satan. By Cotton Mather; publiſhed by the ſpecial command of his excellency the governor of the province of Maſſachuſet's Bay in New England." Printed firſt at Boſton in New-England, and reprinted at London, in 1736, 4to.

MATLOCK, a town or village of Derbyſhire, near Wickſworth, ſituated on the very edge of the Derwent; noted for its bath, the water of which is milk-warm; and remarkable for the huge rocks in its environs, particularly thoſe called the *Torr*, on the eaſt ſide of the Derwent, over againſt it, which ſeem to be piled upon another. It is an extenſive ſtraggling village, built in a very romantic ſtyle, on the ſteep ſide of a mountain, riſing irregularly from the bottom to nearly the ſummit. Near the bath are ſeveral ſmall houſes, whoſe ſituation is on the little natural horizontal parts of the mountain, a few yards above the road, and in ſome places the roofs of ſome almoſt touch the floors of others. There are excellent accommodations for company who reſort to the bath; and the poorer inhabitants are ſupported by the ſale of petrifactions, cryſtals, &c. and notwithſtanding the rockineſs of the ſoil, the cliffs produce an immenſe number of trees, whoſe foliage adds greatly to the beauty of the place.

MATRASS, Cucurbit, or Bolt-head, among chemiſts See Chemistry, n° 579.

MATRICARIA, Feverfew, in botany: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ*. The receptacle is naked; there is no pappus; the calyx hemiſpherical and imbricated, with the marginal leafets ſolid, and ſomething ſharp. There are five ſpecies, but the only remarkable one is the parenthium or common feverfew. This hath very fibrous cluſtering roots, crowned with numerous compound leaves; upright ſtalks branching on every ſide two or three feet high; garniſhed with compound plain leaves of ſeven oval folicles, cut into many parts: and all the branches terminated by many compound radiated white flowers having a yellow diſk. There are varieties with double flowers, with ſemi-double flowers, with double fiſtular flowers, with a fiſtular diſc and plain radius, with ſhort-rayed flowers, with rayleſs flowers, with rayleſs ſulphur-coloured heads, and with finely curled leaves.—All theſe varieties flower abundantly in June, each flower being compoſed of numerous hermaphrodite and female florets; the former compoſe the diſk, the latter the radius or border, and which, in the double and fiſtulous kinds, are very ornamental in gardens, but of a diſagreeable odour; and are all ſucceeded by plenty of ſeed in autumn, by which they are eaſily propagated, as well as by parting the roots and cuttings.

Medical uſes. This plant has received a moſt extraordinary character in hyſteric and other affections of the nerves, as well as for being a carminative or warm ſtimulating bitter. Dr Lewis, however, thinks it inferior to camomile; with which he ſays it agrees in all its ſenſible qualities, only being ſomewhat weaker.

MATRICE, or Matrix. See Matrix.

Matrice, or matrix, in dyeing, is applied to the five ſimple colours, whence all the reſt are derived or compoſed. Theſe are, the black, white, blue, red, and yellow or root colour.

Matrice, or matrices, uſed by the letter-founders, are thoſe little pieces of copper or braſs, at one end whereof are engraven, dent-wiſe, or *en creux*, the ſeveral characters uſed in the compoſing of books. Each character, virgula, and even each point in a diſcourſe, has its ſeveral matrix; and of conſequence, its ſeveral puncheon to ſtrike it. They are the engravers on metal that cut or grave the matrices.

When types are to be caſt, the matrice is faſtened to the end of a mould, ſo diſpoſed as that when the metal is poured on it, it may fall into the creux or cavity of the matrice, and take the figure and impreſſion thereof. See *Letter-Foundery*.

Matrices, uſed in coining, are pieces of ſteel in form of dyes, whereon are engraven the ſeveral figures, arms, characters, legends, &c. wherewith the ſpecies are to be ſtamped. The engraving is performed with ſeveral puncheons, which being formed in relievo, or prominent, when ſtruck on the metal, make an indented impreſſion, which the French call *en creux*.

MATRICULA, a regiſter kept of the admiſſion of officers and perſons entered into any body or ſociety whereof a liſt is made. Hence thoſe who are admitted into univerſities are ſaid to be matriculated. Among eccleſiaſtical authors, we find mention made of two kinds of matriculæ; the one containing a liſt of the eccleſiaſtics called *matricula clericorum*; the other of the poor ſubſiſted at the expence of the church, called *matricula pauperum*.

Matricula was alſo applied to a kind of alms-houſe, where the poor were provided for. It had certain revenues appropriated to it, and was uſually built near the church; whence the name was alſo frequently given to the church itſelf.

MATRIMONY. See Marriage.

MARTRIX, in anatomy, the womb, or that part of the female of any kind, wherein the fœtus is conceived and nouriſhed till the time of its delivery. See Anatomy, n° 108.

Matrix is alſo applied to places proper for the generation of vegetables, minerals, and metals. Thus the earth is the matrix wherein ſeeds ſprout; and marcaſites are by many conſidered as the matrices of metals.

The matrix of ores is the earthy and ſtony ſubſtances in which theſe metallic matters are enveloped: theſe are very various, frequently ſpar, quartz, fluors, or horn-blend.

MATRON, an elderly married woman.

Jury of Matrons. When a widow feigns herſelf with child in order to exclude the next heir, and a ſuppoſititious birth is ſuſpected to be intended, then, upon the writ *de ventre inſpiciendo*, a jury of women is to be impanelled to try the queſtion whether the women is with child or not. So, if a woman, is convicted of a capital offence, and, being condemned to ſuffer death, pleads in ſtay of execution, that ſhe is pregnant, a jury of matrons is impanelled to inquire into the truth of the allegation; and, if they find it true, the convict is reſpited till after her delivery.

MATRONA, (anc. geog.) a river ſeparating Gallia Celtica from the Belgica (Ceſar.) Now the Marne; which, riſing in Champaign near Langres, runs northweſt, and then weſt, and paſſing by Meaux falls into the Siene at Charenton, two leagues to the eaſt of Paris.

MATRONALIA, a Roman feſtival inſtituted by Romulus, and celebrated on the kalends of March, in honour of Mars. It was kept by matrons in particular, and batchelors, were entirely excluded from any ſhare in the ſolemnity. The men during this feaſt ſent preſents to the women, for which a return was made by them at the Saturnalia: And the women gave the ſame indulgence to their ſervants now which the men gave to theirs at the feaſt of Saturn, ſerving them at table, and treating them as ſuperiors.

MATROSSES, are ſoldiers in the train of artillery, who are next to the gunners, and aſſiſt them in loading, firing, and ſpunging the great guns. They carry firelocks, and march along with the ſtore-waggons, both as a guard, and to give their aſſiſtance in caſe a waggon ſhould break down.

MATSYS (Quintin), painter of hiſtory and portraits, was born at Antwerp in 1460, and for ſeveral years followed the trade of a blackſmith or farrier, at leaſt till he was in his 20th year. Authors vary in their accounts of the cauſe of his quitting his firſt occupation, and attaching himſelf to the art of painting. Some affirm, that the firſt unfolding of his genius was occaſioned by the ſight of a print which accidentally was ſhown to him by a friend who came to pay him a viſit while he was in a declining ſtate of health from the labour of his former employment, and that by his copying the print with ſome degree of ſucceſs, he was animated with a deſire to learn the art of painting. Others ſay, he fell in love with a young women of great beauty, the daughter of a painter, and they allege that love alone wrought the miracle, as he could have no proſpect of obtaining her except by a diſtinguiſhed merit in the profeſſion of painting: for which reaſon he applied himſelf with inceſſant labour to ſtudy and practiſe the art, till he became ſo eminent as to be intitled to demand her in marriage, and he ſucceeded. Whatever truth may be in either of theſe accounts, it is certain that he appeared to have an uncommon genius; his manner was ſingular, not reſembling the manner of any other maſter, and his pictures were ſtrongly coloured and carefully finiſhed, but yet they have ſomewhat dry and hard. By many competent judges it was believed, when they obſerved the ſtrength of expreſſion in ſome of his compoſitions, that if he had ſtudied in Italy to acquire ſome knowledge of the antiques and the great maſters of the Roman ſchool, he would have proved one of the moſt eminent painters of the Low countries. But he only imitated ordinary life; and ſeemed more inclined, or at leaſt more qualified, to imitate the defects than the beauties of nature. Some hiſtorical compoſitions of this maſter deſerve commendation; particularly a deſcent from the croſs, which is in the cathedral at Antwerp: and it is juſtly admired for the ſpirit, ſkill, and delicacy of the whole. But the moſt remarkable and beſt known picture of Matſys, is that of the two miſers in the gallery at Windſor. He died in 1529. He had a ſon *John*; who painted in the ſame ſtile and manner, but not with a reputation equal to his father; though many of his pictures are ſold to unſkilful purchaſers for the paintings of Quintin. His moſt frequent ſubject was the repreſentation of miſers counting their gold, or bankers examining and weighing it.

MATT, in a ſhip, is a name given to rope-yarn, junk, &c. beat flat and interwoven; uſed in order to preſerve the yards from galling or rubbing in hoiſting or lowering them.

MATTER, in common language, is a word of the ſame import with *body*, and denotes that which is tangible, viſible, and extended; but among philoſophers it ſignifies that ſubſtance of which all bodies are compoſed; and in this ſenſe it is ſynonymous with the word ELEMENT.

It is only by the ſenſes that we have any communication with the external world; but the immediate objects of ſenſe, philoſophers have in general agreed to term *qualities*, which they conceive as inhering in ſomething which is called their *ſubject* or *ſubſtratum*. It is this ſubſtratum of ſenſible qualities which, in the language of philoſophy, is denominated *matter*; ſo that *matter* is *not* that which we immediately ſee or handle, but the *concealed ſubject* or *ſupport* of viſible, and tangible qualities. What the moderns term *qualities*, was by Ariſtotle and his followers called *form*; but ſo far as the two doctrines are intelligible, there appears to be no eſſential difference between them. From the moderns we learn, that body conſiſts of *matter* and *qualities*; and the peripatetics taught, the ſame thing when they ſaid that body is compoſed of *matter* and *form*.

How philoſophers were led to analyſe body into matter and form, or, to uſe modern language, into matter and qualities; what kind of exiſtence they attribute to each: and whether *matter* muſt be conceived as ſelf-exiſtent or created—are queſtions which ſhall be conſidered afterwards (See METAPHYSICS). It is ſufficient here to have defined the term.

MATTHEW, or *Goſpel of St* MATTHEW, a canonical book of the New Teſtament.

St MATTHEW wrote his goſpel in Judæa, at the requeſt of thoſe he had converted; and it is thought he began in the year 41, eight years after Chriſt's reſurrection. It was written according to the teſtimony of all the ancients, in the Hebrew or Syriac language; but the Greek verſion, which now paſſes for the original, is as old as the apoſtolical times.

St MATTHEW, *the Evangeliſt's Day*, a feſtival of the Chriſtian church, obſerved on September 21ſt.

St MATTHEW, the ſon of Alpheus, was alſo called *Levi*. He was of Jewiſh original, as both his names diſcover, and probably a Galilean. Before his call to the apoſtolate, he was a publican or toll-gatherer to the Romans: an office of bad repute among the Jews, on account of the covetouſneſs and exaction of thoſe who managed it; St Matthew's office particularly conſiſting in gathering the cuſtoms of all merchandiſe that came by the ſea of Galilee, and the tribute that paſſengers were to pay who went by water. And here it was that Matthew ſat at the receipt of cuſtom, when our Saviour called him to be a diſciple. It is probable, that, living at Caparnaum, the place of Chriſt's uſual reſidence, he might have ſome knowledge of him before he was called. Matthew immediately expreſſed his ſatisfaction in being called to this high dignity, by entertaining our Saviour and his diſciples at a great dinner at his own houſe, whither he invited all his friends, eſpecially thoſe of his own profeſſion, hoping, probably, that they might be influenced by the company and converſation of Chriſt. St Matthew continued with the reſt of the apoſtles till after our Lord's aſcenſion. For the firſt eight years afterwards he preached in Judæa. Then he betook himſelf to propagating the goſpel among the Gentiles,

Gentiles, and choſe Ethiopia as the ſcene of his apoſtolical miniſtry; where it is ſaid he ſuffered martyrdom, but by what kind of death is altogether uncertain. It is pretended, but without any foundation, that Hyrtacus, king of Ethiopia, deſiring to marry Iphigenia, the daughter of his brother and predeceſſor Æglippus, and the apoſtle having repreſented to him that he could not lawfully do it, the enraged prince ordered his head immediately to be cut off. Baronius tells us, the body of St Matthew was tranſported from Ethiopia to Bithynia, and from thence was carried to Salernum in the kingdom of Naples in the year 654, where it was found in 1080, and where duke Robert built a church bearing his name.

St Matthew, a town of Spain, in the kingdom of Arragon, ſeated in a pleaſant plain, and in a very fertile country watered with many ſprings. W. Long. 0. 15. Nat. 40. 22.

Matthew of Paris. See Paris.

Matthew of Weſtminſter, a Benedictine monk and accompliſhed ſcholar, who wrote a hiſtory from the beginning of the world to the end of the reign of Edward I. under the title of *Flores Hiſtoriarum*; which was afterwards continued by other hands. He died in 1380.

St MATTHIAS, an apoſtle, was choſen, inſtead of Judas. He preached in Judæa and part of Æthiopia, and ſuffered martyrdom. See the *acts of the Apoſtles*, chap. i. There was a goſpel publiſhed under Matthias's name, but rejected as ſpurious; as likewiſe ſome traditions, which met with the ſame fate.

St Matthias's Day; a feſtival of the Chriſtian church, obſerved on the 24th of February. St Matthias was an apoſtle of Jeſus Chriſt, but not of the number of the twelve choſen by Chriſt himſelf. He obtained this high honour upon a vacancy made in the college of the apoſtles by the treaſon and death of Judas Iſcariot. The choice fell on Matthias by lot; his competitor being Joſeph called *Barſabas* and ſirnamed *Juſtus*. Matthias was qualified for the apoſtleſhip, by having been a conſtant attendant upon our Saviour all the time of his miniſtry. He was, probably, one of the 70 diſciples. After our Lord's reſurrection, he preached the goſpel firſt in Judæa. Afterwards it is probable he travelled eaſtwards, his reſidence being principally near the irruption of the river Apſarus and the haven Hyſſus. The barbarous people treated him with great rudeneſs and inhumanity: and, after many labours and ſufferings in converting great numbers to Chriſtianity, he obtained the crown of martyrdom; but by what kind of death, is uncertain.—They pretend to ſhow the relics of St Matthias at Rome: and the famous abbey of St Matthias near Treves boaſts of the ſame advantage; but doubtleſs both without any foundation. There was a goſpel aſcribed to St Matthias; but it was univerſally rejected as ſpurious.

MATTIACÆ Aquæ, or Mattiaci Fontes, (anc. geog), now Wiſbaden, oppoſite to Mentz, in the Weteravia. E. Long. 8. N. Lat. 50. 6.

MATTIACUM, or Mattium, (anc. geog.) a town of the Mattiaci, a branch of the Catti in Germany. Now Marpurg in Heſſe. E. Long. 8. 40. N Lat. 50. 40.

MATTINS, the firſt canonical hour, or the firſt part of the daily ſervice, in the Romiſh church.

MATTHIOLUS (Peter Andrew), an eminent phyſician in the 16th century, born at Sienna, was well ſkilled in the Greek and Latin tongues. He wrote learned commentaries on Dioſcorides, and other works which are eſteemed; and died in 1577.

MATURANTS, in pharmacy, medicines which promote the ſuppuration of tumors.

MATY (Matthew), M. D. an eminent phyſician and polite writer, was born in Holland in the year 1718. He was the ſon of a clergyman, and was originally intended for the church; but in conſequence of ſome mortifications his father met with from the ſynod, on account of ſome particular ſentiments he entertained about the doctrine of the Trinity, turned his thoughts to phyſic. He took his degree of M. D. at Leyden: and in 1740 came to ſettle in England, his father having determined to quit Holland for ever. In order to make himſelf known, in 1749 he began to publiſh in French an account of the productions of the Engliſh preſs, printed at the Hague under the name of the *Journal Britannique*. This journal, which continues to hold its rank amongſt the beſt of thoſe which have appeared ſince the time of Bayle, anſwered the chief end he intended by it, and introduced him to the acquaintance of ſome of the moſt reſpectable literary characters of the country he had made his own. It was to their active and uninterrupted friendſhip he owed the places he afterwards poſſeſſed. In 1758 he was choſen fellow, and in 1765, on the reſignation of Dr Birch, who died a few months after and made him his executor, ſecretary to the royal ſociety. He had been appointed one of the under librarians of the Britiſh muſeum at its firſt inſtitution in 1753, and became principal librarian at the death of Dr Knight in 1772. Uſeful in all theſe poſts, he promiſed to be eminently ſo in the laſt, when he was ſeized with a languiſhing diſorder, which in 1776 put an end to a life which had been uniformly devoted to the purſuit of ſcience and the offices of humanity. He was an early and active advocate for inoculation; and when there was a doubt entertained that one might have the ſmall-pox this way a ſecond time, tried it upon himſelf unknown to his family. He was a member of the medical club (with the Drs Parſons, Templeman, Fothergill, Watſon, and others), which met every fortnight in St Paul's churchyard. He was twice married, *viz*, the firſt time to Mrs Elizabeth Boiſragon; and the ſecond to Mrs Mary Deners. He left a ſon and three daughters. He had nearly finiſhed the Memoirs of the Earl of Cheſterfield; which were completed by his ſon-in-law Mr Juſtamond, and prefixed to that nobleman's Miſcellaneous Works, 1777, 2 vols 4to.

Maty (Paul Henry), M. A. F. R. S. ſon of the former, was educated at Weſtminſter and Trinity college Cambridge, and had their travelling fellowſhip for three years. He was afterwards Chaplain to Lord Stormont at Paris in 17. ., and ſoon after vacated his next fellowſhip by marrying one of the three daughters of Joſeph Clark, Eſq; ſiſter of the late Captain Charles Clark (who ſucceeded to the command on the death of Captain Cook). On his father's death in 1776, he ſucceeded to the office of one of the under librarians of the Britiſh muſeum, and was afterwards preferred to a ſuperior department, having the care of the antiquities, for which he was eminently well qualified. In 1776 he alſo ſucceeded his father in the office of ſecretary to the royal ſociety. On the diſputes reſpecting the reinſtatement of Dr Hutton in the department of ſecretary for foreign correſpondence 1784, Mr Maty took a warm and diſtinguiſhed part, and reſigned the office of ſecretary: after which he undertook to aſſiſt gentlemen or ladies in perfecting their knowledge of the Greek, Latin, French, and Italian claſſics. Mr Maty was a thinking conſcientious man; and having conceived ſome doubts about the articles he had ſubſcribed in early life, he never could be prevailed upon to place himſelf in the way of eccleſiaſtical preferment, though his connections were amongſt thoſe who could have ſerved him eſſentially in this point; and ſoon after his father's death he withdrew himſelf from miniſtering in the eſtabliſhed church, his reaſons for which he publiſhed in the 47th volume of the Gent. Magazine, p. 466. His whole life was thenceforwards taken up in literary purſuits. He received 100l. from the duke of Marlborough, with a copy of that beautiful work the *Gemmæ Marlburienſes*, of which only 100 copies were worked off for preſents; and of which Mr Maty wrote the French account, as Mr Bryant did the Latin. In January 1782 he ſet on foot a Review of publications, principally foreign, which he carried on, with great credit to himſelf and ſatisfaction to the public, for near five years, when he was obliged to diſcontinue it from ill health. He had long laboured under an aſthmatic complaint, which at times made great ravages in his conſtitution, and at laſt put a period to his life in Jan. 1787, at the age of 42; leaving behind him one ſon.—Mr Maty enjoyed a reſpectable rank in the republic of letters, and by his talents and attainments was fully intitled to it. He was eminently acquainted with ancient and modern literature, and particularly converſant in critical reſearches. The purity and probity of his nature were unqueſtionable; and his humanity was as exquiſite as it would have been extenſive, had it been ſeconded by his fortune.

MAUCAUCO, Macaco, or *Maki*. in zoology. See LEMUR, nº 4.

MAVIS, in ornithology, a ſpecies of Turdus. See TURDUS.

MAUBEUGE, a town of the Netherlands, in Hainault, with an illuſtrious abbey of canoneſſes, who muſt be noble both by the father and mother's ſide. This place was ceded to France in 1678; and fortified after the manner of Vauban. It is ſeated on the river Sambre, in E. Long. 5. 0. N. Lat 50. 15.

MAUNCH, in heraldry, the figure of an ancient coat ſleeve, borne in many gentlemens eſcutcheons.

MAUNDY THURSDAY, is the Thurſday in Paſſion week: which was called *Maunday* or *Mandate Thurſday* from the command which our Saviour gave his apoſtles to commemorate him in the Lord's ſupper, which he this day inſtituted: or from the new commandment which he gave them to love one another, after he had waſhed their feet as a token of his love to them.

MAUPERTUIS (Peter Louis Morceau de), a celebrated French academician, was born at St Malo in 1698; and was there privately educated till he arrived at his 16th year, when he was placed under the celebrated profeſſor of philoſophy M. le Blond, in the college of la Marche, at Paris. He ſoon diſcovered a paſſion for mathematical ſtudies, and particularly for geometry. He likewiſe practiſed inſtrumental muſic in his early years with great ſucceſs; fixed on no profeſſion till he was 20, when he entered into the army. He firſt ſerved in the Grey Muſqueteers; but in the year 1720, his father purchaſed him a company of cavalry in the regiment of La Rocheguyon. He remained but five years in the army, during which time he purſued his mathematical ſtudies with great vigour; and it was ſoon remarked by M. Freret and other academicians, that nothing but geometry could ſatisfy his active ſoul and unbounded thirſt for knowledge. In the year 1723, he was received into the Royal Academy of Sciences, and read his firſt preformance, which was a memoir upon the conſtruction and form of muſical inſtruments, November 16. 1724. During the firſt years of his admiſſion he did not wholly confine his attention to mathematics; he dipt into natural philoſophy, and diſcovered great knowledge and dexterity in obſervations and experiments upon animals. If the cuſtom of travelling into remote climates, like the ſages of antiquity, in order to be initiated into the learned myſteries of thoſe times, had ſtill ſubſiſted, no one would have conformed to it with greater eagerneſs than M. de Maupertuis. His firſt gratification of this paſſion was to viſit the country which had given birth to Newton; and during his reſidence at London he became as zealous an admirer and follower of that philoſopher as of any one of his own countrymen. His next excurſion was to Baſil in Switzerland, where he formed a friendſhip with the famous John Bernouilli, and his family, which continued to his death. At his return to Paris, he applied himſelf to his favourite ſtudies with greater zeal than ever:—And how well he fulfilled the duties of an academician, may be gathered by running over the memoirs of the academy from the year 1724 to 1736; where it appears that he was neither idle nor occupied by objects of ſmall importance. The moſt ſublime queſtions in geometry and the relative ſciences received from his hands that elegance, clearneſs, and preciſion ſo remarkable in all his writings. In the year 1736, he was ſent by the king of France to the polar circle, to meaſure a degree in order to aſcertain the figure of the earth, accompanied by Meſſrs Clairault. Camus, Le Monnier, l' Abbé Outhier, and Celſius the celebrated profeſſor of aſtronomy at Upſal. This diſtinction rendered him ſo famous, that, at his return, he was admitted a member of almoſt every academy in Europe.

In the year 1740 Maupertuis had an invitation from the king of Pruſſia to go to Berlin; which was too flattering to be refuſed. His rank among men of letters had not wholly effaced his love for his firſt profeſſion, namely, that of arms. He followed his Pruſſion majeſty into the field, and was a witneſs of the diſpoſitions and operations that preceded the battle of Molwitz: but was deprived of the glory of being preſent, when victory declared in favour of his royal patron, by a ſingular kind of adventure. His horſe, during the heat of the action; running away with him, he fell into the hands of the enemy; and was at firſt but roughly treated by the Auſtrian ſoldiers, to whom he could not make himſelf known for want of language; but being carried priſoner to Vienna, he received ſuch honours from their imperial majeſties as were never effaced from his memory. From Vienna he returned to Berlin; but as the reform of the academy which the king of Pruſſia then meditated was not yet mature, he went again to Paris, where his affairs called him, and was choſen in 1742 director of the academy of ſciences. In 1743 he was received into the French academy; which was the firſt inſtance of the ſame perſon being a member of both the academies at Paris at the ſame time. M. de Maupertuis again aſſumed the ſoldier at the ſiege of Fribourg, and was pitched upon by marſhal Cogny and the count d'Argenſon to carry the news to the French king of the ſurrender of that citadel.

He returned to Berlin in the year 1744, when a marriage was negotiated and brought about, by the good offices of the queen-mother, between our author and mademoiſelle de Borck, a lady of great beauty and merit, and nearly related to M. de Borck at that time miniſter of ſtate. This determined him to ſettle at Berlin, as he was extremely attached to his new ſpouſe, and regarded this alliance as the moſt fortunate circumſtance of his life.

In the year 1746, M. de Maupertuis was declared by his Pruſſian majeſty preſident of the royal academy of ſciences at Berlin, and ſoon after by the ſame prince was honoured with the order of Merit: However, all theſe accumulated honours and advantages, ſo far from leſſening his ardour for the ſciences, ſeemed to furniſh new allurements to labour and application. Not a day paſſed but he produced ſome new project or eſſay for the advancement of knowledge. Nor did he confine himſelf to mathematical ſtudies only: metaphyſics, chemiſtry, botany, polite literature, all ſhared his attention, and contributed to his fame. At the ſame time, he had, it ſeems, a ſtrange inquietude of ſpirit, with a dark atrabilaire humour, which rendered him miſerable amidſt honours and pleaſures. Such a temperament did not promiſe a very pacific life; and he was engaged in ſeveral quarrels. He had a quarrel with Koenig the profeſſor of philoſophy at Franeker, and another more terrible with Voltaire. Maupertuis had inſerted into the volume of Memoirs of the Academy of Berlin for 1746, a diſcourſe upon the laws of motion; which Koenig was not content with attacking, but attributed to Leibnitz. Maupertuis, ſtung with the imputation of plagiariſm, engaged the academy of Berlin to call upon him for his proof; which Koenig failing to produce, he was ſtruck out of the academy, of which he was a member. Several pamphlets were the conſequence of this; and Voltaire, for ſome reaſon or other, engaged againſt Maupertuis. We ſay, for ſome reaſon or other: becauſe Maupertuis and Voltaire were apparently upon the moſt amicable terms; and the latter reſpected the former as his maſter in the mathematics. Voltaire, however, exerted all his wit and ſatire againſt him; and on the whole was ſo much tranſported beyond what was thought right, that he found it expedient in 1753 to quit the court of Pruſſia.

Our philoſopher's conſtitution had long been conſiderably impaired by the great fatigues of various kinds in which his active mind had involved him; though from the amazing hardſhips he had undergone in his northern expedition, moſt of his future bodily ſufferings may be traced. The intenſe ſharpneſs of the air could only be ſupported by means of ſtrong liquors; which helped but to lacerate his lungs, and bring on a ſpitting of blood, which began at leaſt 12 years before he died. Yet ſtill his mind ſeemed to enjoy the greateſt vigour; for the beſt of his writings were produced, and moſt ſublime ideas developed, during the time of his confinement by ſickneſs, when he was unable to occupy his preſidial chair at the academy. He took ſeveral journeys to St Malo, during the laſt years of his life, for the recovery of his health: And though he always received benefit by breathing his native air, yet ſtill, upon his return to Berlin, his diſorder likewiſe returned with greater violence.—His laſt journey into France was undertaken in the year 1757; when he was obliged, ſoon after his arrival there, to quit his favourite retreat at St Malo, on account of the danger and confuſion which that town was thrown into by the arrival of the Engliſh in its neighbourhood. From thence he went to Bourdeaux, hoping there to meet with a neutral ſhip to carry him to Hamburgh, in his way back to Berlin; but being diſappointed in that hope, he went to Toulouſe, where he remained ſeven months. He had then thoughts of going to Italy, in hopes a milder climate would reſtore him to health; but finding himſelf grow worſe, he rather inclined towards Germany, and went to Neufchatel, where for three months he enjoyed the converſation of Lord Mariſchal, with whom he had formerly been much connected. At length he arrived at Baſil, October 16. 1758, where he was received by his friend Bernouilli and his family with the utmoſt tenderneſs and affection. He at firſt found himſelf much better here than he had been at Neufchatel: but this amendment was of ſhort duration; for as the winter approached, his diſorder returned, accompanied by new and more alarming ſymptoms. He languiſhed here many months, during which he was attended by M. de la Condamine; and died in 1759.

He wrote in French, 1. The figure of the earth determined. 2. The meaſure of a degree of the meridian. 3. A diſcourſe on the parallax of the moon. 4. A diſcourſe on the figure of the ſtars. 5. The elements of geography. 6. Nautical aſtronomy. 7. Elements of aſtronomy. 8. A phyſical diſſertation on a white inhabitant of Africa. 9. An eſſay on coſmography. 10. Reflections on the origin of languages. 11. An eſſay on moral philoſophy. 12. A letter on the progreſs of the ſciences. 13. An eſſay on the formation of bodies. 14. An eulogium on M. de Monteſquieu. 15. Letters, and other works.

MAUR (St), was a celebrated diſciple of St Benedict. If we can believe a life of St Maur aſcribed to Faſtus his companion, he was ſent by Benedict on a miſſion to France. But this life is conſidered as apocryphal. In rejecting it, however, as well as the circumſtances of the miſſion, we muſt beware of denying the miſſion itſelf. It is certain that it was believed in France as early as the 9th century; and notwithſtanding the ſilence of Bede, Gregory of Tours, and others, there are ſeveral documents which prove this, or at leaſt render it extremely probable. A celebrated ſociety of benedictines took the name of *St Maur* in the beginning of the laſt century, and received the ſanction of Pope Gregory XV. in 1621. This ſociety was early diſtinguiſhed by the virtue and the knowledge of its members, and it ſtill ſupports the character. There are perhaps fewer eminent men in it than formerly; but this muſt be aſcribed to the levity of the age, and partly to the little encouragement for the reſearches of learned men. The chief perſons of ingenuity which this ſociety has produced are, the Fathers Menard, d'Acheri, Mabillon, Ruinart, Germain, Lami, Montfaucon, Martin, Vaiſſette, le Nourri, Martianay, Martenne, Maſſuet, &c. &c. See *L'Hiſtoire Letteraire de le Congregation de St Maur*, publiſhed at Paris under the title of *Bruſſels*, in 4to, 1770, by Dom. Taſſin.

MAURICEAU (Francis), a French ſurgeon, who applied himſelf with great ſucceſs and reputation to the theory and practice of his art for ſeveral years at Paris. Afterwards he confined himſelf to the diſorders of pregnant and lying-in women, and was at the head of all the operators in this way. His *Obſervations ſur la groſſeſſe* and *ſur l'accouchment des femmes, ſur leurs maladies, et calles des enfans nouveaux*, 1694, in 4to, is reckoned an excellent work, and has been tranſlated into ſeveral languages; German, Flemiſh, Italian, Engliſh: and the author himſelf tranſlated it into Latin. It is illuſtrated with cuts. He publiſhed another piece or two, by way of ſupplement, on the ſame ſubject; and died at Paris in 1709.

MAURICE (St) commander of the Theban legion, was a Chriſtian, together with the officers and ſoldiers of that legion, amounting to 6600 men.—This legion received its name from the city Thebes in Egypt, where it was raiſed. It was ſent by Diocleſian to check the Bagaudæ, who had excited ſome diſturbances in Gaul. Maurice having carried his troops over the Alps, the emperor Maximinian commanded him to employ his utmoſt exertions to extirpate Chriſtianity. This propoſal was received with horror both by the commander and by the ſoldiers.—The emperor, enraged at their oppoſition, commanded the legion to be decimated; and when they ſtill declared that they would ſooner die than do any thing prejudicial to the Chriſtian faith, every tenth man of thoſe who remained was put to death. Their perſeverance excited the emperor to ſtill greater cruelty; for when he ſaw that nothing could make them relinquiſh their religion, he commanded his troops to ſurround them, and cut them to pieces. Maurice, the commander of theſe Chriſtian heroes, and Exuperus and Candidus, officers of the legion, who had chiefly inſtigated the ſoldiers to this noble reſiſtance, ſignalized themſelves by their patience and their attachment to the doctrines of the Chriſtian religion. They were maſſacred, it is believed, at Agaune, in Chablais, the 22d of September 286.—Notwithſtanding many proofs which ſupport this tranſaction, Dubordier, Hottinger, Moyle, Burnet, and Moſheim, are diſpoſed to deny the fact. It is defended, on the other hand, by Hickes an Engliſh writer, and by Dom Joſeph de Liſle a benedictine monk *de la congregation de Saint Vannes*, in a work of his, intitled, *Defence de la Verité du Martyre de la Legion Thebenne*, 1737. In defence of the ſame fact, the reader may conſult *Hiſtoria di S. Mauritie*, by P. Roſſignole a Jeſuit, and the *Acta Sanctorum* for the month of September. The martyrdom of this legion, written by St Eucherius biſhop of Lyons, was tranſmitted to poſterity in a very imperfect manner by Surius. P. Chifflet a Jeſuit, diſcovered, and gave to the public, an exact copy of this work. Don Ruinart maintains, that it has every mark of authenticity. St Maurice is the patron of a celebrated order in the king of Sardinia's dominions, created by Emanuel Philibert duke of Savoy, to reward military merit, and approved by Gregory XIII. in 1572. The commander of the Theban legion muſt not be confounded with another *St Maurice*, mentioned by Theodoret, who ſuffered martyrdom at Apamea, in Syria.

MAURICE (Mauritius Tiberius), was born at Arabiſſus in Cappadocia, A. D. 539. He was deſcended from an ancient and honourable Roman family.—After he had filled ſeveral offices in the court of Tiberius Conſtantine, he obtained the comand of his armies againſt the Perſians. His gallantry was ſo conſpicuous, that the emperor gave him his daughter Conſtantia in marriage, and inveſted him with the purple in 13th Auguſt 582. The Perſians ſtill continued to make inroads on the Roman territories, and Maurice ſent Philippicus, his brother-in-law, againſt them. This general conducted the war with various ſucceſs. At firſt he gained ſeveral ſplendid victories, but he did not continue to have a decided ſuperiority. As there was great uſe for ſoldiers in theſe unfortunate times, the emperor iſſued a mandate in 592, forbidding any ſoldier to become a monk till he had accompliſhed the term of his military ſervice. Maurice acquired much glory in reſtoring Choſroes II. king of Perſia, to the throne, after he had been depoſed by his ſubjects. The empire was in his reign harraſſed by the frequent inroads of the Arabian tribes. He purchaſed peace from them by granting them a penſion nearly equal to 100,000 crowns; but theſe barbarians took frequent opportunities to renew the war. In different engagements the Romans deſtroyed 50,000, and took 17,000 priſoners. Theſe were reſtored, on condition that the king of the Abari ſhould return all the Roman captives in his dominions. Regardleſs of his promiſe, he demanded a ranſom of 10,000 crowns. Maurice, full of indignation, refuſed the ſum; and the barbarian, equally enraged, put the captives to the ſword. While the emperor to revenge this cruelty, was making preparations againſt the Abari, Phocas, who from the rank of a centurion had attained the higheſt military preferment, aſſumed the purple, and was declared emperor. He purſued Maurice to Chalcedon, took him priſoner, and condemned him to die. The five ſons of this unfortunate prince were maſſacred before his eyes; and Maurice, humbling himſelf under the hand of God, was heard to exclaim, *Thou art juſt, O Lord, and thy judgments are without partiality*. He was beheaded on the 26th November 602, in the 63d year of his age and 20th of his reign. Many writers have eſtimated the character of this prince by his misfortunes inſtead of his actions. They believed him guilty without evidence, and condemned him without reaſon. It cannot be denied, however, that he allowed Italy to be harraſſed, but he was a father to the reſt of the empire. He reſtored the military diſcipline, humbled the pride of his enemies, ſupported the Chriſtian religion by his laws, and piety by his example. He loved the ſciences, and was the patron of learned men.

Maurice, elector of Saxony, ſon of Henry le Pieux, was born A. D. 1521. He was early remarkable for his courage, and during his whole life he was engaged in warlike purſuits. He ſerved under the emperor Charles V. in the campaign of 1544 againſt France; and in the year following againſt the league of Smalkalde; with which, although a Proteſtant, he would have no manner of connection. The emperor, as a reward for his ſervices, in the year 1547, made him elector of Saxony, having deprived his couſin John Frederick of that electorate. Ambition had led him to ſecond the views of Charles, in the hope of being elector, and ambition again detached him from that prince. In 1551 he entered into a league againſt the emperor, together with the elector of Brandenbourg, the Count Palatine, the duke of Wirtemburg, and many other princes. This league, encouraged by the young and enterpriſing Henry II. of France, was more dangerous than that of Smalkalde. The pretext for the aſſociation was the deliverance of the Landgrave of Heſſe, whom the emperor kept priſoner. Maurice and the confederates marched, in 1552, to the defiles of Tirol, and put to flight the Imperial troops who guarded them. The emperor and his brother Ferdinand narrowly eſcaped, and fled from the conquerors in great diſorder. Charles having retired into Paſſau, where he had collected an army, brought the princes of the league to terms of accommodation. By the famous peace of Paſſau, which was finally ratified the 12th of Auguſt 1552, the emperor granted an amneſty without exception to all thoſe who had carried arms againſt him from the year 1546. The Proteſtants not only obtained the free exerciſe of their religion, but they were admitted into the imperial chamber, from which they had been excluded ſince the victory of Mulberg.—Maurice ſoon after united himſelf with the emperor againſt the Margrave of Brandenburg, who laid waſte the German provinces. He engaged him in 1553. gained the battle of Siverſhauſen, and died of the wounds he had received in the engagement two days after. He was one of the greateſt protectors of the Lutherans in Germany, and a prince equally brave and politic. After he had profited by the ſpoils of John Frederick, the chief of the Proteſtants, he became himſelf the leader of the party, and by theſe means maintained the balance of power againſt the emperor in Germany.

Maurice de Naſſau, prince of Orange, ſucceeded to the government of the Low Countries after the death of his father William, who was killed in 1584 by the fanatic Gerard. The young prince was then only eighteen years of age, but his courage and abilities were above his years. He was appointed captain general of the United Provinces, and he reared that edifice of liberty of which his father had laid the foundation. Breda ſubmitted to him in 1590: Zutphen, Deventer, Hulſt, Nimeguen, in 1591. He gained ſeveral important advantages in 1592, and in the year following he made himſelf maſter of Gertrudenburg. When he had performed theſe ſplendid ſervices, he returned to the Low Countries by the way of Zealand. His fleet was attacked by a dreadful tempeſt, in which he loſt forty veſſels, and he himſelf had very nearly periſhed. His death would have been conſidered by the Hollanders as a much greater calamity than the loſs of their veſſels. They watched over his ſafety with exceeding care. In 1594, one of his guards was accuſed of an intention to take away his life; and it was generally believed that he was bribed to this ſervice by the enemies of the republic. He fell a ſacrifice at Bourges, either to his own fanaticiſm or to the jealous anxiety of the friends of Maurice. The prince of Orange, increaſing in reputation, defeated the troops of the archduke Albert in 1597, and drove the Spaniards entirely out of Holland. In 1600 he was obliged to raiſe the ſiege of Dunkirk; but he took ample vengeance on Albert, whom he again defeated in a pitched battle near Newport. Before the action, this great general ſent back the ſhips which had brought his troops into Flanders: *My brethren* (ſaid he to his army), *we muſt conquer the enemy or drink up the waters of the ſea. Determine for yourſelves; I have determined I ſhall either conquer by your bravery, or I ſhall never ſurvive the diſgrace of being conquered by men in every reſpect our inferiors.* This ſpeech elevated the ſoldiers to the higheſt pitch of enthuſiaſm, and the victory was complete. Rhinberg, Grave, and Ecluſe, cities in Flanders, ſubmitted to the conqueror the following year. Maurice, however, not only laboured for the commonwealth, but alſo for himſelf. He coveted the ſovereignty of Holland, and was oppoſed in the proſecution of his deſign by the penſioner Barneveldt. The zeal and activity of this wiſe republican coſt him his life. He was an Arminian; and at this time Maurice defended Gomar againſt Arminius.—Taking advantage of the general odium under which the Arminians lay, he found means to get Barneveldt condemned in 1619. His death, wholly owing to the cruel ambition of the prince of Orange, made a deep impreſſion on the minds of the Hollanders. The truce with Spain being expired, Spinola laid ſiege to Breda in 1624, and in ſix months, by the proper direction of his great talents, though with great ſlaughter of his troops, he took the place. The prince of Orange, unſucceſsful in every attempt to raiſe the ſiege, died of vexation in 1625, aged 55 years, with the reputation of the greateſt warrior of his time.—"The life of this Stadtholder (ſays the Abbé Raynal) was almoſt an uninterrupted ſeries of battles, of ſieges, and of victories. Of moderate abilities in every thing elſe, he ſhone conſpicuous in his military capacity. His camp was the ſchool of Europe, and thoſe who received their military education in his armies augmented, perhaps, the glory of their maſter.—Like Montecuculi, he diſcovered inimitable ſkill in his marches and encampments; like Vauban, he poſſeſſed the talent of fortifying places, and of rendering them impregnable; like Eugene, the addreſs of finding ſubſiſtence for great armies, in countries barren by nature, or ravaged by war; like Vendome, the happy talent of calling forth, in the moment they became neceſſary, greater exertions from his ſoldiers than could reaſonably be expected; like Conde, that infallible quickneſs of eye which decides the fortune of battles; like Charles XII. the art of rendering his troops almoſt invincible to cold, hunger, and fatigue; like Turenne, the ſecret of making war with the leaſt poſſible

ſible expence of human blood." The Chevalier Folard maintains, that Maurice was the greateſt commander of infantry ſince the time of the Romans. He ſtudied the military art of the ancients, and applied their rules with great exactneſs in the various occurrences of war. He not only took advantage of the inventions of others, but he enriched the ſcience of war with ſeveral improvements. Teleſcopes were firſt uſed by him for a military purpoſe; and beſides a kind of gallery in conducting a ſiege, and the plan of blockading a ſtrong place, which were of his invention, he greatly improved the whole art by his method of puſhing an attack with great vigour, and of defending, for the greateſt length of time, and in the beſt manner, a place beſieged. In ſhort, the many uſeful things which he practiſed or invented, placed him in the higheſt rank among men of a military character. On one occaſion, a lady of quality aſked him, *who was the firſt general of the age? Spinola* (replied he) *is the ſecond.* It was his conſtant practice, during ſleep, to have two guards placed by his bedſide, not only to defend him in caſe of danger, but to awake him if there ſhould be the leaſt occaſion. The war betwixt Spain and Holland was never carried on with greater keenneſs and animoſity than during his adminiſtration.— The grand Signior, hearing of the vaſt torrents of blood ſhed in the conteſt, thought that a great empire muſt depend on the deciſion. The object of ſo many battles was pointed out to him on a map, and he ſaid coldly, *If it were my buſineſs, I would ſend my pioneers and order them to caſt this little corner of earth into the ſea.* Maurice, like many great men, was impatient under contradiction, and too much devoted to women. He was ſuceeded by Frederic Henry his brother.

MAURITANIA, an ancient kingdom of Africa, bounded on the weſt by the Atlantic ocean, on the ſouth by Getulia or Lybia Interior, and on the north by the Mediterranean, and comprehending the greater part of the kingdoms of Fez and Morocco. Its ancient limits are not exactly mentioned by any modern neither can they now be aſcertained by any modern obſervations, theſe kingdoms being but little known to Europeans.

This country was originally inhabited by a people called *Mauri*, concerning the etymology of which name authors are not agreed. It is probable, however, that this country or at leaſt a great part of it, was firſt called *Phut*, ſince it appears from Pliny, Ptolemy, and St Jerom, that a river and territory not far from Mount Atlas went by that name. From the Jeruſalem Targum it likewiſe appears, that part of the Mauri may be deemed the offspring of Lud the ſon of Miſraim, ſince his deſcendants mentioned Geneſis x. are there called מרוטאי, *Mouri* or *Mauritani.* It is certain, that this region, as well as the others to the eaſtward of it, had many colonies planted in it by the Phœnicians. Procopius tells us, that in his time two pillars of white ſtone were to be ſeen there, with the following inſcription in the Phœnician language and character, upon them; "We are the *Canaanites*, that fled from *Joſhua* the ſon of Nun, that notorious robber." *Ibnu Rachic*, or *Ibnu Raquig*, an African writer cited by Leo, together with Evagrius and Nicephorus Calliſtus, aſſert the ſame thing.

The Mauritanians, according to Ptolemy, were divide into ſeveral cantons or tribes. The *Metagonitæ* were ſeated near the ſtraits of Hercules, now thoſe of Gibraltar. The *Saccoſii*, or *Cocoſii*, occupied the coaſt of the Iberian ſea. Under theſe two petty nations the *Moſices*, *Verues*, and *Verbicæ* or *Vervicæ*, were ſettled. The *Saliſe*, or *Salinſæ*, were ſituated lower, towards the ocean; and, ſtill more to the ſouth, the *Volubiliani.* The *Maurenſii* and *Herpiditani* poſſeſſed the eaſtern part of this country, which was terminated by the *Mulucha.* The *Angaucani* or *Jangacaucani*, *Nectiberes*, *Zagrenſii*, *Baniubæ*, and *Vacuntæ*, extended themſelves from the ſouthern foot of Ptolemy's Atlas Minor to his Atlas Major. Pliny mentions the *Baniuræ*, whom Father Hardouin takes to be Ptolemy's Baniubæ: and Mela the Atlantes, whom he repreſents as poſſeſſed of the weſtern parts of this diſtrict.

The earlieſt prince of Mauritania mentioned in hiſtory is Neptune: and next to him were Atlas and Antæus his two ſons, both famous in the Grecian fables on account of their wars with Hercules. Antæus, in his contention with that hero, ſeems to have behaved with great bravery and reſolution. Having received large reinforcements of Libyan troops, he cut off great numbers of Hercules's men. But that celebrated commander, having at laſt intercepted a ſtrong body of Libyans ſent to the relief of Antæus, gave him a total overthrow, wherein both he and the beſt part of his forces were put to the ſword. This deciſive action put Hercules in poſſeſſion of Libya and Mauritania, and conſequently of the riches of all theſe kingdoms. Hence came the fable, that Hercules, finding Antæus, a giant of an enormous ſize with whom he was engaged in ſingle combat, to receive freſh ſtrength as often as he touched his mother earth when thrown upon her, at laſt lifted him up in the air and ſqueezed him to death. Hence likewiſe may be deduced the fable intimating that Hercules took the globe from Atlas upon his own ſhoulders, overcame the dragon that guarded the orchards of the Heſperides, and made himſelf maſter of all the golden fruit there. Bochart thinks that the fable alluded chiefly to naval engagements, wherein Hercules, for the moſt part, was victorious: though Antæus from time to time recived ſuccours by ſea. But at laſt Hercules, coming up with one of his ſquadrons which had a ſtrong reinforcement on board made himſelf maſter of it, and thus rendered Antæus incapable for the future of making head againſt him. The ſame author likewiſe inſinuates, that the notion of Antæus's gigantic ſtature prevailing for ſo many centuries amongſt the Tingitanians, pointed out the ſize of the veſſels of which his fleets and ſquadrons were compoſed. As for the golden apples ſo frequently mentioned by the old mythologiſts, they were the treaſures that fell into Hercules's hands upon the defeat of Antæus; the Greeks giving the oriental word מאל, *riches*, the ſignification affixed to their own term *μηλα*, *apples.*

With regard to the age in which atlas and Antæus lived, the moſt probable ſuppoſition ſeems to be that of Sir Iſaac Newton. According to that illuſtrious author, Ammon the father of Seſac was the firſt king of Libya, or that vaſt tract extending from the borders of Egypt to the Atlantic ocean: the conqueſt of which country was effected by Seſac in his father's life-time. Neptune afterwards excited the Libyans to a rebellion againſt Seſac, and ſlew him; and then invaded Egypt under the command of Atlas or Antæus, the ſon of Neptune, Seſac's brother and admiral. Not long after, Hercules, the general of Thebais and Ethiopia for the gods or great men of Egypt, reduced a ſecond time the whole continent of Libya, having overthrown and ſlain Antæus near a town in Thebais, from that event called *Antæa* or *Antæopolis*; this, we ſay, is the notion advanced by Sir Iſaac Newton, who endeavours to prove, that the firſt reduction of Libya, by Seſac, happened a little above a thouſand years before the birth of Jeſus Chriſt, as the laſt, by Hercules, did ſome few years after. Now, though we do not pretend to adopt every particular circumſtance of Sir Iſaac Newton's ſyſtem, yet we cannot forbear obſerving, that it appears undeniably plain from ſcripture, that neither the weſtern extremity of Libya, nor even the other parts of that region, could poſſibly have been ſo well peopled before the time of David or Solomon, as to have ſent a numerous army to invade Egypt. For Egypt and Phœnicia, from whence the greateſt part of the anceſtors of the Libyans came, and which were much nearer the place from whence the firſt diſperſion of mankind was made, could not themſelves have been greatly overſtocked with inhabitants any conſiderable time before the reign of Saul. And that ſuch an invaſion happened in the reign of Neptune, or at leaſt of his ſon Antæus, has been moſt fully evinced by this moſt excellent chronologer.

From the defeat of Antæus, nothing remarkable occurs in the hiſtory of Mauritania till the times of the Romans, who at laſt brought the whole kingdom under their juriſdiction; for which ſee the article Rome. With regard to the cuſtoms, &c. of this people, it would ſeem. from what Hyginus inſinuates, that they fought only with clubs, till one Belus, the ſon of Neptune, as that author calls him, taught them the uſe of the ſword. Sir Iſaac Newton makes this Belus to have been the ſame perſon with Seſoſtris king of Egypt, who over-ran a great part of the then known world. 1. All perſons of diſtinction in Mauritania went richly attired, wearing much gold and ſilver in their cloths. They took great pains in cleanſing their teeth, and curled their hair in a curious and elegant manner. They combed their beards, which were very long, and always had their nails pared extremely cloſe. When they walked out in any numbers, they never touched one another, for fear of diſconcerting the curls into which their hair had been formed. 3. The Mauritanian infantry, in time of action, uſed ſhields made of elephants ſkins, being clad in thoſe of lions, leopards, and bears, which they kept on both night and day. 4. The cavalry of this nation was armed with broad ſhort lances, and carried targets or bucklers, made likewiſe of the ſkins of wild beaſts. They uſed no ſaddles. Their horſes were ſmall and ſwift, had wooden collers about their necks and were ſo much under the command of their riders, that they would follow them like dogs. The habit of theſe horſemen was not much different from that of the foot abovementioned, they conſtantly wearing a large tunic of the ſkins of wild beaſts. The Phutæi, of whom the Mauritanians were a branch, were eminent for their ſhields, and the excellent uſe they made of them, as we learn from Homer, Xenophon, Herodotus, and ſcripture. Nay, Herodotus ſeems to intimate that the ſhield and helmet came from them to the Greeks. 5. Notwithſtanding the fertility of their ſoil, the poorer ſort of the Mauritanians never took care to manure the ground, being ſtrangers to the art of huſbandry; but roved about the country in a wild ſavage manner, like the ancient Scythians or Arabes Scenitæ. They had tents, or *mapalia*, ſo extremely ſmall, that they could ſcarce breathe in them. Their food was corn, herbage, &c. which they frequently did eat green, without any manner of preparation; being deſtitute of wine, oil, and all the elegancies as well as many neceſſaries of life. Their habit was the ſame both in ſummer and winter, conſiſting chiefly of an old tattered, though thick garment, and over it a courſe rough tunic; which anſwered probably to that of their neighbours the Numidians. Moſt of them lay every night upon the bare ground; though ſome of them ſtrewed their garments thereon, not unlike the preſent African Kabyles and Arabs, who, according to Dr Shaw, uſe their hykes for a bed and covering in the night. 6. If the moſt approved reading of Horace may be admitted, the Mauritanians ſhot poiſoned arrows; which clearly intimates, that they had ſome ſkill in the art of preparing poiſons, and were excellent dartmen. This laſt obſervation is countenanced by Herodian and Ælian, who entirely come into it, affirming them to have been in ſuch continual danger of being devoured by wild beaſts, that they durſt not ſtir out of their tents or mapalia without their darts. Such perpetual exerciſe muſt render them exceedingly ſkilful in hurling that weapon. 7. The Mauritanians ſacrificed human victims to their deities, as the Phœnicians, Carthaginians, &c. did.

The country people were extremely rude and barbarous; but thoſe inhabiting cities muſt undoubtedly have had at leaſt ſome ſmattering in the literature of the ſeveral nations they deduced their origin from. That the Mauritanians had ſome knowledge in naval affairs ſeems probable, not only from the intercourſe they had with the Phœnicians and Carthaginians, as well as the ſituation of their country; but likewiſe from Orpheus, or Onomacritus, who aſſerts them to have made a ſettlement at the entrace into Colchis, to which place they came by ſea. Magic, ſorcery, divination, &c. they appear to have applied themſelves to in very early times. Cicero and Pliny ſay, that Atlas was the inventor of aſtrology and the doctrine of the ſphere, i. e. he firſt introduced them into Mauritania. This, according to Diodorus Siculus, gave riſe to the fable of Atlas's bearing the heavens upon his ſhoulders. The ſame author relates, that Atlas inſtructed Hercules in the doctrine of the ſphere and aſtrology, or rather aſtronomy, who afterwards brought thoſe ſciences into Greece.

MAURITIA, the Ginkgo, or *maiden-hair tree*: A genus of plants belonging to the natural order of Palmæ. The calyx of the male is monophyllous; the corolla monopetalous; with ſix ſtamina. It is a native of Japan, where it is alſo known by the names of *Ginan* and *Itſio*. It riſes with a long, erect, thick and branched ſtem, to the ſize of a walnut tree. The

bark

bark is aſh-coloured, the wood brittle and ſmooth, the pith ſoft and fungous. The leaves are large, expanded from a narrow bottom into the figure of a maiden-hair leaf, unequally parted, ſtreaked, without fibres or nerves; both ſurfaces having the ſame appearance, and ſupported upon footſtalks, which are compreſſed upon the upper ſurface and extended into the ſubſtance of the leaf. From the uppermoſt ſhoots hang the flowers in long catkins that are filled with the fertilizing powder; and to which ſucceeds the fruit, adhering to a thick fleſhy pedicle, which proceeds from the boſom of the leaves. This fruit is either exactly or nearly round, and of the appearance and ſize of a damaſk plum. The ſubſtance ſurrounding the fruit is fleſhy, juicy, white, very harſh, and adheres ſo firmly to the incloſed nut, as not to be ſeparated from it, except by putrefaction. The nut, properly termed *Gineau*, reſembles the piſtachia nut, eſpecially a Perſian ſpecies named *bergjes piſtai*; but is almoſt double in ſize, and of the figure of an apricot ſtone. The ſhell is ſomewhat white, woody, and brittle; and incloſes a white looſe kernel, having the ſweetneſs of an almond, along with a degree of harſhneſs. Theſe kernels taken after dinner are ſaid to promote digeſtion, and to give relief in ſurfeits; whence they never fail to make part of the deſert in great feaſts and anniverſary entertainments.—Many of theſe plants have been reared by Mr James Gordon at his nurſery near Mile-end. They ſeem to be very hardy, and thrive in Britain in the open air.

MAURITIUS, or MAURICE, an iſland of Africa, about 400 miles eaſt of Madagaſcar, lying in the latitude of 20 and 21 degrees ſouth. In the beginning of the 16th century it was diſcovered by the Portugueſe, who, knowing that Pliny and other ancient writers had mentioned the iſland of Cerne in theſe ſeas, took it for granted that this muſt be it; and accordingly we find it ſtyled *Cerne* or *Sirne*, in their maps; but, notwithſtanding this, they did not think fit to ſettle it; and indeed their force was ſo ſmall, in compariſon of the vaſt dominions they graſped, that it was very excuſable. However, according to their laudable cuſtom, they put ſome hogs, goats, and other cattle upon it, that in caſe any of their ſhips either going to the Indies, or returning to Portugal, ſhould be obliged to touch there, they might meet with refreſhments. The Dutch, in the ſecond voyage they made to the Eaſt Indies under their admiral James Cornelius Vanneck, came together with five ſhips on the 15th of September 1561; anchored in a commodious port, to which they gave the name of *Warwick Haven*; and gave a very good account of the place in their journals. Captain Samuel Caſtleton, in the Pearl, an Engliſh Eaſt India ſhip, arrived there on the 27th of March 1612; and taking it to be an iſland undiſcovered before, beſtowed upon it the name of *England's Foreſt*, though others of his crew called it *Pearl-Iſland*, and in the account of their voyage, written by John Tatton the maſter of the ſhip, celebrated it as a place very convenient for ſhipping, either outward or homeward bound, to refreſh at. This they ſometimes accordingly did, and brought ſome cargoes of ebony and rich wood from thence, but without fixing any ſettlement.

At length, in 1638, the Dutch ſeated themſelves here; and it is highly remarkable, that at the very time they were employed in making their firſt ſettlement, the French ſent a veſſel, to take poſſeſſion of it, who found the Dutch before-hand with them, and refuſed the aſſiſtance of an Engliſh Indiaman, wooding and watering in another port of the iſland, who very frankly offered it, to drive the Dutch from their half-ſettled poſts. They continued for ſome time in quiet poſſeſſion of the place they fortified in this iſland, to which they gave the name of *Mauritius*. But having engaged the French, who were ſettled on Madagaſcar, to ſteal 50 of the natives, and ſell them for ſlaves, for the improvement for the Dutch ſettlements here, this proved the ruin of both colonies: for the negroes ſurpriſed and maſſacred the French in Madagaſcar: and the ſlaves in Mauritius fled into the centre of the iſland; from whence they ſo much and ſo inceſſantly moleſted thoſe who had been formerly their maſters, that they choſe to quit a country where they could no longer remain in any tolerable degree of ſafety. The Eaſt India company, however, from motives of conveniency, and a very imperfect notion of its value, diſapproved this meaſure, and therefore ordered it to be reſettled; which was accordingly done, and three forts erected at the principal havens. Things now went on ſomewhat better than they did before; but they were ſtill very much diſturbed by the revolted negroes in the heart of the iſle, whom they could never ſubdue. One principal uſe that the company made of this place, was to ſend thither ſtate-priſoners, who, as they were not men of the beſt morals, quickly corrupted the reſt of the inhabitants, and rendered them ſuch a race of outrageous ſmugglers, the ſituation of the place concurring with their bad diſpoſitions, that, after various ineffectual attempts made to reform them, orders at length were given to abandon Mauritius a ſecond time, which, after ſome delays, were put in execution in the year 1710.

Two year after this, the French took poſſeſſion of it, and named it the *iſle de France*. This name has obtained among themſelves, but the Europeans in general continue to call it Mauritius. It lies in S. Lat. 20. 15. E. Lon. 6. 15. The inconveniences ariſing from the want of a port at the iſland of Bourbon, induced the French to take poſſeſſion of Mauritius, it having two very good harbours, to fortify which no expence has been ſpared. That on the north-weſt is called *Port-Louis*, that on the ſouth-eaſt ſide of the iſland is called *Port-Bourbon*. The trade-wind from the ſouth-eaſt in theſe latitudes blows all the year round, excepting for a few days at the ſummer ſolſtice, when it is interrupted by hard gales and hurricanes from the north. The eaſe with which this wind enables ſhips to enter the port of Bourbon, cauſed the French, when they firſt took poſſeſſion of this ſpot, to eſteem it the beſt port in the iſland; but experience pointing out to them, that the ſame wind often rendered the paſſage out of the harbour ſo difficult, that a ſhip was ſometimes obliged to wait a conſiderable time before the weather admitted of her putting to ſea, this harbour is in a great meaſure abandoned, and the principal town and ſeat of government is now fixed at port Louis, which is nearly in the middle of the north ſide of the iſland, and its entrance is through a channel formed by two ſhoals, which advance about two miles into the ſea. When a ſhip arrives oppoſite to this channel, the ſouth-eaſt wind hinders her from entering the port under ſail, and ſhe muſt either warp in with cables or be towed in with boats. The neceſſity of this operation, joined to the extreme narrowneſs of the channel, which does not admit of two ſhips abreaſt of each other entering at the ſame time, is one of the beſt defences the harbour has againſt an attack by ſea; for, from theſe obſtacles, an enemy would find it a matter of the greateſt difficulty to force the port; and in addition to this natural ſtrength, they have built two forts and as many batteries, which are mounted with heavy cannon, and entirely command the approach to the harbour, would ſhips preſume to force an entry under ſail. This port is capable of containing 100 ſail of ſhips, and is well provided with every requiſite for repairing and even building of ſhips. This port has proved of the greateſt advantage to France in the ſeveral wars which have been carried on between Great Britain and her: and has proved of great utility to the French Eaſt India company's commerce: for here their ſhips and crews were ſure to meet with all neceſſary refreſhment after a long voyage. The port of Bourbon is alſo fortified: and an army landed here would find it an extreme difficult taſk to paſs the mountains to the different parts of the iſland. There are ſeveral places between the north-eaſt extremity and port Louis where boats may land, but all theſe are defended by batteries; and the country behind them is a continued thicket: The reſt of the coaſt is inacceſſible. In the north-eaſtern quarter is a plain extending about 10 miles from eaſt to weſt, and in ſome places five miles inland from the northern coaſt. All the reſt of the iſland is full of high and ſteep mountains, lying ſo near to one another, and the intervals between them ſo narrow, that, inſtead of valleys, they rather reſemble the beds of torrents; and theſe are choaked with huge fragments of rocks which have fallen from the ſteep ſides of the impending mountains. On the ſummits of the mountains ice is frequently to be found, and they are covered with foreſts of ebony and other large trees. The ground they ſhade produces herbage, ſhrubs, and plants of various ſorts, from the common graſs to the ſtrongeſt thorn, and that in ſuch profuſion, that they form a thicket ſo cloſely interwoven that no progreſs can be made but by means of a hatchet. Notwithſtanding theſe difficulties, plantations have been formed on theſe mountains, and very conſiderable progreſs has been made in the plains: but the productions, although moſtly of the ſame kind, are not only in leſs quantity, but of an inferior quality to thoſe produced at Bourbon iſland.

In a courſe of years, however, this ſettlement coſt ſo much, and was conſidered in every light worth ſo little, that it had been more than once under deliberation, whether, after the example of the Dutch, they ſhould not leave it again to its old negro inhabitants; which ſooner or later in all likelihood would have been its fate, if, in 1735, the famous M. de la Bourdonnais had not been ſent thither, with the title of *governor-general of the French iſlands*.

He found this iſle in the worſt ſtate poſſible, thinly inhabited by a ſet of lazy people, who equally hated induſtry and peace, and who were continually flattering this man to his face, and belying him wherever and as far as they durſt. He gave himſelf no trouble about this, having once found the means to make himſelf obeyed; he ſaw the vaſt importance of the iſland; he conceived that it might be ſettled to great advantage; and, without ſo much as expecting the thanks of thoſe for whom he laboured, he began to execute this great deſign. His firſt ſtep was to bring over black boys from Madagaſcar, whom he carefully trained up in good principles, and in continual exerciſe; by which he rendered them ſo good ſoldiers, that he very quickly obliged the Marones, or wild negroes, either to ſubmit or to quit the iſland: he taught the planters to cultivate their lands to advantage; he, by an aqueduct, brough freſh water to the ſea-ſide; and whereas they had not ſo much as a boat at his coming thither, he made a very fine dock, where he not only built ſloops and larger veſſels, but even a ſhip of the burden of 500 tons. However incredible it may ſeem, yet it is certainly fact, that in the ſpace of five years he converted this country into a paradiſe, that had been a mere wilderneſs for 5000; and this in ſpite of the inhabitants, and of the company, who being originally prejudiced by them, behaved ill to him at his return. He ſoon made the cardinal de Fleury, however, ſenſible of the true ſtate of things; and compelled the company to acknowledge, though they did not reward, his ſervices. He afterwards returned into the Indies, and perfected the work he had begun, and to him it is owing that the iſle of France was rendered one of the fineſt and moſt important ſpots upon the globe. Here no coffee is raiſed, but by the indefatigable induſtry of M. de Bourdonnais, ſugar, indigo, pepper, and cotton (which are not at Bourbon), came to be cultivated with ſucceſs. Since the departure of that moſt excellent governor; the plantations have been neglected, and are fallen off: but if a proper ſpirit of activity was raiſed among the inhabitants, they might ſoon be made to reſume their flouriſhing appearance. Mines of iron have been diſcovered in the mountains near the great plain, in the north-eaſt part of the iſland; and theſe mountains affording in great abundance the neceſſary fuel, forges have been erected: but the iron produced is of a very inferior quality, it being brittle, and only fit for making cannon-balls and bomb-ſhells. Black cattle, ſheep, and goats, are preſerved with difficulty; the firſt generally die before they have been a year in the iſland, and this occaſions frequent importations of them from Madagaſcar and other parts. Common domeſtic poultry breed in great plenty; and, with fiſh and turtle, furniſh a great part of the food of the European inhabitants.

The approach to the iſland is extremely dangerous, it being ſurrounded with ledges of locks, and many of them covered by the ſea. The ſhore abounds with coral and ſhells. This iſland is ſaid to contain 90 rivers: ſome are conſiderable ſtreams, and moſt of them have their ſources from lakes, of which there are ſeveral in the middle part of the iſland. The rivers afford plenty of various kinds of fiſh, particularly eels. Theſe are of an enormous ſize, ſome having been found that were ſix feet long, and ſix inches in circumference, and ſo extremely voracious, that it is dangerous to bathe

bathe in thoſe parts of the river where they lie, as they will ſeize a man without fear, and have ſtrength ſufficient to keep him under water till he is drowned. Here is a great variety of birds, and bats as large as a young kitten: the inhabitants eſteem them a delicate morſel. The air is both hot and moiſt, but not unwholeſome. The place abounds with inſects, which are very troubleſome; but there are no ſerpents. It has been diſcovered, that off Port Louis the ſouth-eaſt wind generally blows with leaſt ſtrength about ſun-riſe; and it alſo happens, on four or five days, at intervals, in the courſe of a month, that early in the morning the wind ceaſes in the northern part of the iſland for an hour or two, when a breeze riſes, although but faintly, from the north-weſt; during which, a ſhip ſtationed at the entrance of the channel to avail herſelf of this breeze, may enter the harbour and attack the forts.

MAURUA, one of the Society-Iſlands in the South Sea. It is a ſmall iſland, entirely ſurrounded with a ridge of rocks, and without any harbour for ſhipping. It is inhabited; and its productions are the ſame with thoſe of the neighbouring iſlands. A high round hill riſes in the middle of it, which may be ſeen at the diſtance of 10 or 12 leagues.

MAUSOLEUM, a magnificent tomb or funeral monument. The word is derived from Mauſolus king of Caria, to whom Artemiſia his widow erected a moſt ſtately monument, eſteemed one of the wonders of the world, and called it, from his own name, *Mauſoleum*.

St MAWES, a town of Cornwall, in England, ſeated on the eaſt ſide of Falmouth haven, in W. Long. 5. 26. N. Lat. 50. 30. Though but a hamlet of the pariſh of St Juſt, two miles off, without a miniſter, or either church, or chapel, or meeting-houſe, it has ſent members to parliament ever ſince 1562, who are returned by its mayor or portreve. It conſiſts but of one ſtreet, under a hill, and fronting the ſea, and its inhabitants ſubſiſt purely by fiſhing. King Henry VIII. built a caſtle here, over againſt Pendennis, for the better ſecurity of Falmouth haven. It has a governor, a deputy, and two gunners, with a platform of guns. Here is a fair the Friday after St Luke's day.

MAXENTIUS (Marcus Aurelius Valerius), a ſon of the emperor Maximianus Hercules, was, by the voluntary abdication of Diocleſian, and of his father, raiſed to the empire, A. D. 306. He afterwards incited his father to re-aſſume his imperial authority; and in a perfidious manner deſtroyed Severus, who had delivered himſelf into his hands, and relied upon his honour for the ſafety of his life. His victories and ſucceſſes were impeded by Galerius Maximianus, who oppoſed him with a powerful force. The defeat and voluntary death of Galerius ſoon reſtored peace to Italy; and Maxentius paſſed into Africa, where he rendered himſelf odious by his cruelty and oppreſſion. He ſoon after returned to Rome, and was informed that Conſtantine was come to dethrone him. He gave his adverſary battle near Rome, and, after he had loſt the victory, he fled back to the city. The bridge over which he croſſed the Tiber was in a decayed ſituation, and he fell into the river, and was drowned, A. D. 312. The cowardice and luxuries of Maxentius were as conſpicuous as his cruelties. He oppreſſed his ſubjects with heavy taxes, to gratiſy the cravings of his pleaſures, or the avarice of his favourites. He was debauched in his manners, and neither virtue nor innocence were ſafe whenever he was inclined to voluptuous purſuits. His body was deformed, and unwieldy To viſit a pleaſure ground, or to exerciſe himſelf under a marble portico, or walk on a ſhady terrace, was to him a Herculean labour, which required the greateſt exertions of ſtrength and reſolution.

MAXILLA, the Jaw. See Anatomy, nº 20—26.

MAXIM, an eſtabliſhed propoſition or principle; in which ſenſe it denotes much the ſame with axiom.

MAXIMILIAN I. emperor of Germany, ſignalized himſelf againſt the French while he was king of the Romans, and after he was emperor entered into the army of Henry VIII. of England as a volunteer againſt that nation: he was a protector of learned men, and aboliſhed an iniquitous tribunal, ſtyled *Judicium oculum Weſtphaliæ:* he compoſed ſome poems, and the memoirs of his own life. He died in 1519, aged 60.

MAXIMUM, in mathematics, denotes the greateſt quantity attainable in any given caſe.

If a quantity conceived to be degenerated by motion increaſes or decreaſes till it arrives at a certain magnitude or poſition, and then, on the contrary, grows greater or leſſer, and it be required to determine the ſaid magnitude or poſition, the queſtion is called a *problem de maximis et minimis*.

MAXIMUS, a celebrated Cynic philoſopher, and magician of Epheſus. He inſtructed the emperor Julian in magic; and, according to the opinion of ſome hiſtorians, it was in the converſation and company of Maximus that the apoſtacy of Julian originated. The emperor not only viſited the philoſopher, but he even ſubmitted his writings to his inſpection and cenſure. Maximus refuſed to live in the court of Julian, and the emperor, not diſſatiſfied with the refuſal, appointed him high pontiff in the province of Lydia, an office which he diſcharged with the greateſt moderation and juſtice. When Julian went into the eaſt, the philoſopher promiſed him ſucceſs, and even ſaid that his conqueſts would be more numerous and extenſive than thoſe of the ſon of Philip. He perſuaded his imperial pupil, that, according to the doctrine of Metempſychoſis, his body was animated by the ſoul which once animated the hero whoſe greatneſs and victories he was going to eclipſe. After the death of Julian, Maximus was almoſt ſacrificed to the fury of the ſoldiers; but the interpoſition of his friends ſaved his life, and he retired to Conſtantinople. He was ſoon after accuſed of magical practices, before the emperor Valens, and beheaded at Epheſus, A. D. 366. He wrote ſome philoſophical and rhetorical treatiſes, ſome of which were dedicated to Julian. They are all now loſt.

Maximus of Tyre, a Platonic philoſopher, went to Rome in 146, and acquired ſuch reputation there, that the emperor Marcus Aurelius became his ſcholar, and gave him frequent proofs of his eſteem. This philoſopher is thought to have lived till the reign of the emperor Commodus. There are ſtill extant 41 of his diſſertations; a good edition of which was printed by

Daniel Heinſius, in 1624, in Greek and Latin, with notes.

MAXIMUS MARIUS. See *Marius*.

MAXIMUS (St), an abbot and confeſſor of the 7th century, was of a noble family of Conſtantinople, and diſtinguiſhed himſelf by his zeal againſt the Monothelites, for which he was thrown into priſon, and died there on the 13th of Auguſt 1662. He wrote a Commentary on the books attributed to Dionyſius the Areopagite, and ſeveral other works, of which an edition has been publiſhed by father Combeſis.

MAY, the fifth month in the year, reckoning from our firſt, or January; and the third, counting the year to begin with March, as the Romans anciently did. It was called Maius by Romulus, in reſpect to the ſenators and nobles of his city, who were named *majores*; as the following month was called *Junius*, in honour of the youth of Rome, *in honorem juniorum*, who ſerved him in the war; though ſome will have it to have been thus called from *Maia*, the mother of Mercury, to whom they offered ſacrifice on the firſt day of it; and Papias derives it from *Madius, eo quod tunc terra madeat*. In this month the ſun enters Gemini, and the plants of the earth in general begin to flower.—The month of May has ever been eſteemed favourable to love; and yet the ancients, as well as many of the moderns, look on it as an unhappy month for marriage. The original reaſon may perhaps be referred to the feaſt of the Lemures, which was held in it. Ovid alludes to this in the fifth of his *Faſti*, when he ſays,

Nec viduæ tædis eadem, nec virginis apta
Tempora; quae nupſit, non diuturna fuit;
Hac quoque de cauſa, ſi te proverbia tangunt,
Menſe malum Maio *nubere vulgus ait.*

May-dew. See DEW.

May-duke, a ſpecies of cherry. See PRUNUS.

MAY (Iſle of), a ſmall iſland at the mouth of the Frith of Forth, in Scotland, about a mile and an half in circumference, and ſeven miles from the coaſt of Fife, almoſt oppoſite to the rock called the *Baſs*. It formerly belonged to the priory of Pittenweem; and was dedicated to St Adrian, ſuppoſed to have been martyred in this place by the Danes; and hither, in times of Popiſh ſuperſtition, barren women uſed to come and worſhip at his ſhrine, in hopes of being cured of their ſterility. Here is a tower and lighthouſe built by Mr Cunningham of Barns, to whom king Charles I. granted the iſland in fee, with power to exact two-pence per ton from every ſhip that paſſes, for the maintenance of a light-houſe. In the middle of it there is a freſh-water ſpring, and a ſmall lake. The ſoil produces paſturage for 100 ſheep and 20 black cattle. On the weſt ſide the ſteep rocks render it inacceſſible; but to the eaſt there are four landing-places and good riding. It was here that the French ſquadron, having the chevalier de St George on board, anchored in the year 1708, when the vigilance of Sir George Byng obliged him to relinquiſh his deſign, and bear away for Dunkirk. The ſhores all round the iſland abound with fiſh, and the cliffs with water-fowl.

MAY (Thomas), an eminent Engliſh poet and hiſtorian in the 17th century, was born of an ancient but decayed family in Suſſex, educated at Cambridge, and afterwards removed to London, where he contracted a friendſhip with ſeveral eminent perſons, and particularly with Endymion Porter, Eſq; one of the gentlemen of the bed-chamber to king Charles I. While he reſided at court, he wrote the five plays now extant under his name. In 1622, he publiſhed a tranſlation of Virgil's Georgics, with annotations; and in 1635 a poem on king Edward III. and a tranſlation of Lucan's Pharſalia, which poem he continued down to the death of Julius Cæſar, both in Latin and Engliſh verſe. Upon the breaking out of the civil wars he adhered to the parliament; and in 1647, he publiſhed, "The hiſtory of the parliament of England, which began November the third MDCXL. With a ſhort and acceſſary view of ſome precedent years." In 1649, he publiſhed, *Hiſtoriæ parliamenti Angliæ Breviarium*, in three parts; which he afterwards tranſlated into Engliſh. He wrote the Hiſtory of Henry II. in Engliſh verſe. He died in 1652. He went well to reſt over-night, after a cheerful bottle as uſual, and died in his ſleep before morning: upon which his death was imputed to his tying his night-cap too cloſe under his fat cheeks and chin, which cauſed his ſuffocation; but the facetious Andrew Marvel has written a poem of 100 lines, to make him a martyr of Bacchus, and die by the force of good wine. He was interred near Camden, in Weſtminſter-Abbey; which cauſed Dr Fuller to ſay, that, "if he were a biaſſed and partial writer, yet he lieth buried near a good and true hiſtorian indeed." Soon after the reſtoration, his body, with thoſe of ſeveral others, was dug up, and buried in a pit in St Margaret's church-yard; and his monument, which was erected by the appointment of Parliament, was taken down and thrown aſide.

MAYER (Tobias), one of the greateſt aſtronomers and mechanics this century has produced, was born at Maſpach, in the duchy of Wirtemberg 1723. He taught himſelf mathematics, and at the age of fourteen deſigned machines and inſtruments with the greateſt dexterity and juſtneſs. Theſe purſuits did not hinder him from cultivating the belles lettres. He acquired the Latin tongue, and wrote it with elegance. In 1750, the univerſity of Gottingen choſe him for their mathematical profeſſor; and every year of his ſhort life was thenceforward marked with ſome conſiderable diſcoveries in geometry and aſtronomy. He publiſhed ſeveral works in this way, which are all reckoned excellent; and ſome are inſerted in the ſecond volume of the "Memoirs of the univerſity of Gottingen." His labours ſeem to have exhauſted him; for he died worn out in 1762.

MAYERNE (Sir Theodore de), baron of Aulbone, was th ſon of Lewis de Mayerne, the celebrated author of The general hiſtory of Spain, and of the *Monarchie ariſto-democratique*, dedicated to the ſtates-general. He was born in 1573, and had for his godfather Theodore Beza. He ſtudied phyſic at Montpelier, and was made phyſician in ordinary to Henry IV. who promiſed to do great things for him provided he would change his religion. James I. of England invited him over, and made him firſt phyſician to himſelf and his queen, in which office he ſerved the whole royal family to the time of his death in

1655. His works were printed at London in 1700, and make a large folio, divided into two books; the firſt containing his *Conſilia, Epiſtolæ, & Obſervationes;* the ſecond his *Pharmacopœia variæque medicamentorum formulæ.*

MAYHEM. See MAIM.

MAYNE (Jaſper,), an eminent Engliſh poet and divine in the 17th century, who was bred at Oxford, and entered into holy orders. While his majeſty reſided at Oxford, he was one of the divines appointed to preach before him. He publiſhed in 1647 a piece intitled, ΟΧΛΟΜΑΧΙΑ, or, *The people's war examined according to the principles of reaſon and ſcripture, by Jaſper Mayne.* In 1648 he was deprived of his ſtudentſhip at Chriſt-church, and two livings he had; but was reſtored with the king, who made him his chaplain and archdeacon of Chicheſter; all which he held till he died. Dr Mayne was held in very high eſteem both for his natural parts and his acquired accompliſhments. He was an orthodox preacher, and a man of ſevere virtue and exemplary behaviour: yet of a ready and facetious wit, and a very ſingular turn of humour. From ſome ſtories that are related of him, he ſeems to have borne ſome degree of reſemblance in his manner to the celebrated Dr Swift; but if he did not poſſeſs thoſe very brilliant parts that diſtinguiſhed the Dean, he probably was leſs ſubject to that capricious and thoſe unaccountable whimſies which at times ſo greatly eclipſed the abilites of the latter. Yet there is one anecdote related of him, which although it reflects no great honour on his memory, as it ſeems to carry ſome degree of cruelty with it, yet is it a ſtrong mark of his reſemblance to the Dean, and a proof that his propenſity for drollery and joke did not quit him even in his lateſt moments. The ſtory is this: The doctor had an old ſervant, who had lived with him ſome years, to whom he had bequeathed an old trunk, in which he told him he would find *ſomething that would make him drink after his death.* The ſervant, full of expectation that his maſter, under this familiar expreſſion, had left him ſomewhat that would be a reward for the aſſiduity of his paſt ſervices, as ſoon as decency would permit flew to the trunk; when behold, to his great diſappointment, the boaſted legacy proved to be a red herring. The doctor, however, bequeathed many legacies by will to pious uſes; particularly 50 pounds towards the rebuilding of St Paul's cathedral, and 200 pounds to be diſtributed to the poor of the pariſhes of Caſſington and Pyrton, near Wattington, of both which places he had been vicar. In his younger years he had an attachment to poetry; and wrote two plays, the latter of which may be ſeen in the tenth volume of Dodſley's collection, viz. 1. Amorous war, a tragi-comedy. 2. The city match, a comedy. He publiſhed a poem upon the naval victory by the duke of York over the Dutch, printed in 1665. He alſo tranſlated into Engliſh from the Greek part of Lucian's Dialogues.

MAYNOOTH, or MANOOTH, a poſt town in the county of Kildare, and province of Leinſter, in Ireland, near 12 miles from Dublin. Though not very large, it is regularly laid out, and conſiſts of good houſes. Here is a charter-ſchool, which was opened 27th July 1759.

MAYNWARING (Arthur), an eminent political writer in the beginning of the 18th century, ſtaid ſeveral years at Oxford, and then went to Cheſhire, where he lived ſome time with his uncle Mr Francis Cholmondley, a very honeſt gentleman, but extremely averſe to the government of king William III. to whom he refuſed the oaths. Here he proſecuted his ſtudies in polite literature with great vigour; and coming up to London, applied to the ſtudy of the law. He was hitherto very zealous in anti-revolutional principles, and wrote ſeveral pieces in favour of king James II.; but upon being introduced to the duke of Somerſet and the earls of Dorſet and Burlington, began to entertain very different notions in politics. His father left him an eſtate of near 800 l. a-year, but ſo incumbered, that the intereſt money amounted to almoſt as much as the revenue. Upon the concluſion of the peace he went to Paris, where he became acquainted with Mr Boileau. After his return he was made one of the commiſſioners of the cuſtoms, in which poſt he diſtinguiſhed himſelf by his ſkill and induſtry. He was a member of the kit-cat-club, and was loooked upon as one of the chief ſupports of it by his pleaſantry and wit. In the beginning of queen Anne's reign, the lord treaſurer Godolphin engaged Mr Done to quit the office of auditor of the impreſts, and made Maynwaring a preſent of a patent for that office worth about 2000 l. a-year in a time of buſineſs. He had a conſiderable ſhare in the Medley; and was author of ſeveral other pieces. The Examiner, his antagoniſt in politics, allowed that he wrote with tolerable ſpirit and in a maſterly ſtyle. Sir Richard Steele dedicated the firſt volume of the Tatler to him.

MAYO, one of the Cape de Verd iſlands, lying in the Atlantic ocean, near 300 miles from Cape Verd in Africa, about 17 miles in circumference. The ſoil in general is very barren, and water ſcarce; however, they have ſome corn, yams, potatoes, and plantains, with plenty of beeves, goats, and aſſes. What trees there are, grow on the ſides of the hills, and they have ſome figs and water-melons. The ſea round about the iſland abounds with fiſh. The chief commodity is ſalt, with which many Engliſh ſhips are loaded in the ſummer-time. The principal town is Pinoſa, inhabited by negroes, who ſpeak the Portugueſe language, and are ſtout, luſty, and fleſhy. They are not above 200 in number, and many of them go quite naked. W. Long. 21. 25. N. Lat. 15. 5.

MAYO, a county of Ireland, in the province of Connaught, having Sligo and the ſea on the north, Roſcommon on the ſouth, Leitrim and Roſcommon on the eaſt, and the Atlantic ocean on the weſt. It contains 724,640 Iriſh plantation acres, 73 pariſhes, 9 baronies, and one borough; and ſends four members to parliament. It gives title of earl to the family of Bourke. This county takes its name from an ancient city, built in 664; the ruins of the cathedral, and ſome traces of the ſtone walls which encompaſſed the city, yet remain on the plains of Mayo. It was a univerſity, founded for the education of ſuch of the Saxon youths as were converted to the Chriſtian faith: it was ſituated a little to the ſouth of Lough Conn; and is to this day frequently called *Mayo of the Saxons*, being celebrated for giving education to Alfred the great king of England. As this town has gone to decay, Balinrobe is reckoned the chief town. The county by the ſea is mountainous; but inland has good paſtures, lakes, and rivers. It is about 57 miles long, and 48 broad. Caſtlebar is the aſſizes town.—Mayo was formerly a biſhop's ſee, which is now united to TUAM.

MAYOR, the chief magiſtrate of a city or town, choſen annually out of the aldermen. The word, anciently wrote *meyr*, comes from the Britiſh, *miret* i. e. *cuſtodire*, or from the old Engliſh *maier*, viz. *poteſtas*, and not from the Latin *major*. King Richard I. in 1189, changed the bailiff of London into a mayor, and from that example king John made the bailiff of King's Lynn a mayor anno 1204: Though the famous city of Norfolk obtained not this title for its chief magiſtrate till the ſeventh year of king Henry V. anno 1419; ſince which there are few towns of note in England but have had a mayor appointed for government.

Mayors of corporations in England are juſtices of peace *pro tempore*, and they are mentioned in ſeveral ſtatutes; but no perſon ſhall bear any office of magiſtracy concerning the government of any town-corporation, &c. who hath not received the ſacrament according the church of England within one year before his election, and who ſhall not take the oaths of ſupremacy, &c.

If any perſon intrudes into the office of mayor, a *quo warranto* lies againſt him, upon which he ſhall not only be ouſted, but fined. And no mayor, or perſon holding an annual office in a corporation for one year, is to be elected in the ſame office for the next; in this caſe, perſons obſtructing the choice of a ſucceſſor are ſubject to 100 l. penalty. Where the mayor of a corporation is not choſen on the day appointed by charter, the next office in place ſhall the day after hold a court and elect one; and if there be a default or omiſſion that way, the electors may be compelled to chooſe a mayor, by a writ of mandamus out of the king's bench. Mayors, or other magiſtrates of a corporation, who ſhall voluntarily abſent themſelves on the day of election, are liable to be impriſoned, and diſqualified from holding any office in the corporation.

Mayor's Courts. To the lord mayor and city of London belong ſeveral courts of judicature. The higheſt and moſt ancient is that called the *huſtings*, deſtined to ſecure the laws, rights, franchiſes, and cuſtoms of the city. The ſecond is a court of *requeſt*, or of *conſcience*; of which before. The third is the court of the lord mayor and aldermen, where alſo the ſheriffs ſit: to which may be added two courts of ſheriffs and the court of the city orphans, whereof the lord mayor and aldermen have the cuſtody. Alſo the court of common council, which is a court or aſſembly, wherein are made all by-laws which bind the citizens of London. It conſiſts, like the parliament, of two houſes: an upper, conſiſting of the lord mayor and aldermen; and a lower, of a number of common council men, choſen by the ſeveral wards, as repreſentatives of the body of the citizens. In the court of common council are made laws for the advancement of trade, and committees yearly appointed, &c. But acts made by them are to have the aſſent to the lord mayor and aldermen, by ſtat. 11 Geo. I. Alſo the chamberlain's court, where every thing relating to the rents and revenues of the city, as alſo the affairs of ſervants, &c. are tranſacted. Laſtly, to the lord mayor belong the courts of coroner and of eſcheator; another court for the conſervation of the river Thames; another of gaol-delivery, held uſually eight times a year, at the Old Bailey, for the trial of criminals, whereof the lord mayor is himſelf the chief judge. There are other courts called *wardmotes* or meeting of the wards; and courts of halymote or aſſemblies of the ſeveral guilds and fraternities.

MAZA, among the Athenians, was a ſort of cake made of flour boiled with water and oil, and ſet, as the common fare, before ſuch as were entertained at the public expence in the common hall or *prytaneum*.

MAZAGAN, a ſtrong place of Africa, in the kingdom of Morocco, and on the frontiers of the province of Duguela. It was fortified by the Portugueſe, and beſieged by the king of Morocco with 200,000 men in 1562, but to no purpoſe. It is ſituated near the ſea. W. Long. 7. 45. N. Lat. 35. 5.

MAZARA, an ancient town of Sicily, and capital of a conſiderable valley of the ſame name, which is very fertile, and watered with ſeveral rivers. The town is a biſhop's ſee, and has a good harbour; is ſeated on the ſea coaſt, in E. Long. 12. 39. N. Lat. 37. 42.

MAZARINE (Julius), a famous cardinal and prime miniſter of France, was born at Piſcina in the province of Abruzzo, in Naples, in 1602. After having finiſhed his ſtudies in Italy and Spain, he entered into the ſervice of cardinal Sachetts, and became well ſkilled in politics, and in the intereſts of the princes at war in Italy; by which means he was enabled to bring affairs to an accommodation, and the peace of Queiras was ſhortly concluded. Cardinal Richelieu being taken with his conduct, did from thenceforward highly eſteem him: as did alſo cardinal Antonio, and Louis XIII. who procured him a cardinal's hat in 1641. Richelieu made him one of the executors of his will; and during the minority of Louis XIV. he had the charge of affairs. At laſt he became the envy of the nobility, which occaſioned a civil war whereupon Mazarine was forced to retire, a price was ſet on his head, and his library ſold. Notwithſtanding he afterwards returned to the court in more glory than ever; concluded a peace with Spain, and a marriage treaty betwixt the king and the infanta. This treaty of peace paſſes for the maſter-piece of cardinal de Mazarine's politics, and procured him the French king's moſt intimate confidence: but at laſt his continual application to buſineſs threw him into a diſeaſe, of which he died at Vinciennes in 1661.—Cardinal Mazarine was of a mild and affable temper. One of his greateſt talents was his knowing mankind, and his being able to adapt himſelf, and to aſſume a character conformable to the circumſtances of affairs. He poſſeſſed at one and the ſame time the biſhopric of Metz, and the abbeys of St Arnauld, St Clement, and St Vincent, in the ſame city; that of St Dennis, Clugny, and Victor, of Marſeilles; of St Michael at Soiſſons, and a great number of others. He founded Mazarine-college at Paris, which is alſo called the *college of the four nations*. There has been publiſhed a collection of his letters, the moſt copious edition of which is that of 1745, in 2 vols duodecimo.

MAZZUOLI. See PARMIGIANO.

MEAD, a wholeſome, agreeable liquor, prepared of honey and water.

One of the beſt methods of preparing mead is as follows: Into twelve gallons of water ſlip the whites of ſix eggs; mixing theſe well together, and to the mixture adding twenty pounds of honey. Let the liquor boil an hour, and when boiled add cinnamon, ginger, cloves, mace, and a roſemary. As ſoon as it is cold, put a ſpoonful of yeſt to it, and tun it up, keeping the veſſel filled as it works; when it has done working, ſtop it up cloſe; and, when fine, bottle it off for uſe.

Thorley ſays, that mead not inferior to the beſt of foreign wines may be made in the following manner: Put three pounds of the fineſt honey to one gallon of water, and two lemon peels to each gallon; boil it half an hour, well ſcummed; then put in, while boiling, lemon peel: work it with yeſt; then put it in your veſſel with the peel, to ſtand five or ſix months, and bottle it off for uſe. If it is to be kept for ſeveral years, put four pounds to a gallon of water.

The author of the Dictionary of Chemiſtry directs to chooſe the whiteſt, pureſt, and beſt-taſted honey, and to put it into a kettle with more than its weight of water: a part of this liquor muſt be evaporated by boiling, and the liquor ſcummed, till its conſiſtence is ſuch, that a freſh egg ſhall be ſupported on its ſurface without ſinking more than half its thickneſs into the liquor; then the liquor is to be ſtrained, and poured through a funnel into a barrel; this barrel, which ought to be nearly full, muſt be expoſed to a heat as equable as poſſible, from 20 to 27 or 28 degrees of Mr Reaumer's thermometer, taking care that the bung-hole be ſlightly covered, but not cloſed. The phenomena of the ſpirituous fermentation will appear in this liquor, and will ſubſiſt during two or three months, according to the degree of heat; after which they will diminiſh and ceaſe. During this fermentation, the barrel muſt be filled up occaſionally with more of the ſame kind of liquor of honey, ſome of which ought to be kept a part, on purpoſe to replace the liquor which flows out of the barrel in Froth. When the fermentation ceaſes, and the liquor has become very vinous, the barrel is then to be put into a cellar, and well cloſed; a year afterwards the mead will be fit to be put into bottles.

Mead is a liquor of very ancient uſe in Britain. See the article FEAST, p. 182, col. 1.

MEAD (Dr Richard), a celebrated Engliſh phyſician, was born at Stepeny near London, where his father, the Reverend Mr Matthew Mead, had been one of the two miniſters of that pariſh; but in 1662 was ejected for nonconformity, but continued to preach at Stepney till his death. As Mr Mead had a handſome fortune, he beſtowed a liberal education upon 13 children, of whom Richard was the eleventh; and for that purpoſe kept a private tutor in his houſe, who taught him the Latin tongue. At 16 years of age Richard was ſent to Utrecht, where he ſtudied three years under the famous Grævius; and then chooſing the profeſſion of phyſic, he went to Leyden, where he attended the lectures of the famous Pitcairn on the theory and practice of medicine, and Hermon's botanical courſes. Having alſo ſpent three years in theſe ſtudies, he went with his brother and two other gentlemen to viſit Italy, and at Padua took his degree of doctor of philoſophy and phyſic in 1695. Afterwards he ſpent ſome time at Naples and at Rome; and returning home the next year, ſettled at Stepney, where he married, and practiſed phyſic, with a ſucceſs that laid the foundation of his future greatneſs.

In 1703, Dr Mead having communicated to the Royal Society an analyſis of Dr Bonomo's diſcoveries relating to the cutaneous worms that generate the itch, which they inſerted in the Philoſophical Tranſactions; this, with his account of poiſons, procured him a place in the Royal Society, of which Sir Iſaac Newton was then preſident. The ſame year he was elected phyſician of St Thomas's hoſpital, and was alſo employed by the ſurgeons to read anatomical lectures in the hall, which obliged him to remove into the city. In 1707 his Paduan diploma for doctor of phyſic was confirmed by the univerſity of Oxford; and being patronized by Dr Radcliffe, on the death of that famous phyſician he ſucceeded him in his houſe at Bloomſbury-ſquare, and in the greateſt part of his buſineſs. In 1727 he was made phyſician to King George II. whom he had alſo ſerved in that capacity while he was prince of Wales; and he had afterwards the pleaſure of ſeeing his two ſons-in-law, Dr Nichols and Dr Wilmot, his coadjutors in that eminent ſtation.

Dr Mead was not more to be admired for the qualities of the head than he was to be loved for thoſe of his heart. Though he was himſelf a hearty whig, yet uninfluenced by party-principles, he was a friend to all men of merit, by whatever denomination they might happen to be diſtinguiſhed. Thus he was intimate with Garth, with Arbuthnot, and with Friend; and long kept up a conſtant correſpondence with the great Boerhaave, who had been his fellow-ſtudent at Leyden: they communicated to each other their obſervations and projects, and never loved each other the leſs for being of different ſentiments. In the mean time, intent as Dr Mead was on the duties of his profeſſion, he had a greatneſs of mind that extended itſelf to all kinds of literature, which he ſpared neither pains nor money to promote. He cauſed the beautiful and ſplendid edition of Thuanus's hiſtory to be publiſhed in 1713, in ſeven volumes folio: and by his interpoſition and aſſiduity, Mr Sutton's invention of drawing foul air from ſhips and other cloſe places was carried into execution, and all the ſhips in his majeſty's navy provided with this uſeful machine. Nothing pleaſed him more than to call hidden talents into light; to give encouragement to the greateſt projects, and to ſee them executed under his own eye. During almoſt half a century he was at the head of his buſineſs, which brought him one year above ſeven thouſand pounds, and for ſeveral years between five and ſix thouſand: yet clergymen, and in general all men of learning, were welcome to his advice. His library conſiſted of 10,000 volumes, of which his Latin, Greek, and oriental manuſcripts, made no inconſiderable part. He had a gallery for his pictures and antiquities, which coſt him great ſums. His reputation, not only as a phyſician, but as a ſcholar, was ſo univerſally eſtabliſhed, that he correſponded with all the principal literati in Europe: even the king of Naples ſent to deſire a complete collection of his works; and in return made him a preſent of the two firſt volumes of Signior Bajardi, which may be conſidered as an introduction to the collection of the antiquities of Herculaneum. At the ſame time that prince invited him to his palace, that he might have an opportunity of ſhowing him thoſe valuable monuments of antiquity; and nothing but his great age prevented his undertaking a journey ſo ſuited to his taſte. No foreigner of learning ever came to London without being introduced to Dr Mead; and on theſe occaſions his table was always open, and the magnificence of princes was united with the pleaſures of philoſophers. It was principally to him that the ſeveral counties of England and the colonies abroad applied for the choice of their phyſicians, and he was likewiſe conſulted by foreign phyſicians from Ruſſia, Pruſſia, Denmark, &c. He wrote beſides the above works, 1. A Treatiſe on the Scurvy. 2. *De variolis et morbillis diſſertatio.* 3. *Medica ſacra: ſive de Morbis inſignioribus, qui in Bibliis memorantur, Commentarius.* 4. *Monita et Præcepta medica.* 5. A Diſcourſe concerning peſtilential contagion, and the methods to be uſed to prevent it. The works he wrote and publiſhed in Latin were tranſlated into Engliſh, under the doctor's inſpection, by Thomas Stack, M. D. and F. R. S. This great phyſician, naturaliſt, and antiquarian, died on the 16th of February 1754.

MEADOW, in its general ſignification, means paſture or graſs-land, annually mown for hay: but it is more particularly applied to lands that are ſo as to be too moiſt for cattle to graze upon them in winter without ſpoiling the ſward.

1 When the watering of meadows was firſt practiſed in England.

An improvement in agriculture by watering of meadows has of late come into much uſe, and been found of very conſiderable importance. In the Monthly Review for October 1788, the editors acknowledge the favour of a correſpondent, who informed them, that watering of meadows was practiſed during the reigns of Queen Elizabeth and James I. A book was written upon the ſubject by one Rowland Vaughan, who ſeems to have been the inventor of this art, and who practiſed it on a very extenſive plan in the Golden Valley in Herefordſhire. Till this note to the Reviewers appeared, the inhabitants of a village called South-Cerney in Glouceſterſhire had aſſumed the honour of the invention to themſelves, as we are informed in a treatiſe upon the ſubject by the reverend Mr Wright curate of the place. According to a received tradition in that village, watering of meadows has been practiſed there for about a century, and was intorduced by one *Welladviſe*, a wealthy farmer in South-Cerney. His firſt experiment was by cutting a large ditch in the middle of his ground, from which he threw the water over ſome parts, and allowed it to ſtagnate in others: but finding this not to anſwer his expectations, he improved his method by cutting drains and filling up the hollows; and thus he ſucceeded ſo well, that his neighbours, who at firſt had called him a madman, ſoon changed their opinion, and began to imitate his example.

2 Advantages of watering.

The advantages which attend the watering of meadows are many and great; not only as excellent crops of graſs are thus raiſed, but as they appear ſo early, that they are of infinite ſervice to the farmers for food to their cattle in the ſpring before the natural graſs riſes. By watering we have plenty of graſs in the beginning of March, and even earlier when the ſeaſon is mild. The good effects of this kind of graſs upon all ſorts of cattle are likewiſe aſtoniſhing, eſpecially upon ſuch as have been hardly wintered; and Mr Wright informs us, that the farmers in his neighbourhood, by means of watering their lands, are enabled to begin the making of cheeſe at leaſt a month ſooner than their neighbours who have not the ſame advantage. Graſs raiſed by watering is found to be admirable for the nurture of lambs; not only thoſe deſigned for fattening, but ſuch as are to be kept for ſtore: For if lambs when very young are ſtopped and ſtinted in their growth, they not only become contracted for life themſelves, but in ſome meaſure communicate the ſame diminutive ſize to their young. The beſt remedy for preventing this evil is the ſpring feed from watered meadows; and Mr Wright is of opinion, that if the young of all kinds of farmer's ſtock were immediately encouraged by plenty of food, and kept continually in a growing ſtate, there would in a few years be a notable change both in the ſize and ſhape of cattle in general. Such indeed is the forwardneſs of graſs from watered meadows, that the feed between March and May is worth a guinea per acre; and in June an acre will yield two tons of hay, and the after-math is always worth twenty ſhillings; and nearly the ſame quantity is conſtantly obtained whether the ſummer be dry or wet. In dry ſummers alſo, ſuch farmers as water their meadows have an opportunity of ſelling their hay almoſt at any price to their neighbours.

Land conſtantly improves by watering.

Land treated in this manner is continually improving in quality, even though it be mown every year: the herbage, if coarſe at firſt, becomes finer; the ſoil, if ſwampy, becomes ſound; the depth of its mould is augmented, and its quality meliorated every year. "To theſe advantages (ſays Mr Boſwell in his treatiſe upon this ſubject) another may be addreſſed to the gentleman who wiſhes to improve his eſtate, and whoſe benevolent heart prompts him to extend a charitable hand to the relief of the induſtrious poor, and not to idleneſs and vice: almoſt the whole of the expence in this mode of cultivation is the actual manual labour of a claſs of people who have no genius to employ their bodily ſtrength otherwiſe for their own ſupport and that of their families; conſequently, when viewed in this light, the expence can be but comparatively ſmall, the improvement great and valuable."

4 Example of the produce of a watered meadow.

As a proof of the above doctrine, Mr Wright adduces an inſtance of one year's produce of a meadow in his neighbourhood. It had been watered longer than the eldeſt perſon in the neighbourhood could remember; but was by no means the beſt meadow upon the ſtream, nor was the preceding winter favourable for watering. It contains ſix acres and an half. The ſpring-feed was let for ſeven guineas, and ſupported near 200 ſheep from the 1ſt of March till the beginning of May: the hay being ſold for 30 guineas, and the after-math for ſix. Another and ſtill more remarkable proof of the efficacy of watering, is, that two of the moſt ſkilful watermen of that place were ſent to lay out a meadow of ſeven acres, the whole crop of which was that year ſold for two pounds. Though it was thought by many impoſſible to throw the water over it, yet the ſkill of the workmen ſoon overcame all difficulties; and ever ſince that time the meadow has been let at the rent of three pounds per acre. From manifold experience, our author informs us, that the people in that part of the country are ſo much attached to the practice of watering, that they never ſuffer the ſmalleſt ſpring or rivulet to be unemployed. Even thoſe temporary floods occaſioned by ſudden ſhowers are received into proper ditches, and ſpread equally over the lands until its fertilizing property be totally exhauſted, "Neceſſity (ſays he) indeed compels us to make the moſt of every drop: for we have near 390 acres in this pariſh, that muſt all, if poſſible, be watered; and the ſtream that affords the water ſeldom exceeds five yards in breadth and one in depth; therefore we may ſay, that a ſcarcity of water is almoſt as much dreaded by us as by the celebrated inhabitants of the banks of the Nile."

5
The practice of watering ought to be more generally extended.

Conſidering the great advantages to be derived from the practice of watering meadows, and the many undoubted teſtimonies in its favour, Mr Wright expreſſes his ſurpriſe that it has not come into more general uſe, as there is not a ſtream of water upon which a mill can be erected but what may be made ſubſervient to the enriching of ſome land, perhaps to a great quantity. "I am confident (ſays he), that there are in each county of England and Wales 2000 acres upon an average which might be thus treated, and every acre increaſed at leaſt one pound in annual value. The general adoption therefore of watering is capable of being made a national advantage of more than 100,000l. per annum, beſides the great improvement of other land ariſing from the produce of the meadows and the employment of the induſtrious poor. Such an improvement, one would think, is not unworthy of public notice; but if I had doubled the ſum, I believe I ſhould not have exceeded the truth, though I might have gone beyond the bounds of general credibility. In this one pariſh where I reſide there are about 3000 acres now watered; and it may be eaſily proved that the proprietors of the land reap from thence 100l. yearly profit."

In Mr Boſwell's treatiſe upon this ſubject, publiſhed in 1790, the author complains of the neglect of the practice of improving the wet, boggy, ruſhy lands, which lie at the banks of rivers, and might be meliorated at a very ſmall expence, when much larger ſums are expended in the improvement of barren uplands and large tracts of heath in various parts of the kingdom: and he complains likewiſe of the little information that is to be had in books concerning the method of performing this operation. The only author from whom he acknowledges to have received any information is Blyth; and even his method of watering is very different from that practiſed in modern times; for which reaſon he propoſes to furniſh an original treatiſe upon the ſubject; and of this we ſhall now give the ſubſtance.

6
Land capable of being watered.

The firſt thing to be conſidered is, what lands are capable of being watered. Theſe, according to Mr Boſwell, are all ſuch as lie low, near the banks of rivulets and ſprings, eſpecially where the water-courſe is higher than the lands, and kept within its bounds by banks. If the rivulet has a quick deſcent, the improvement by watering will be very great, and the expences moderate. On level lands the water runs but ſlowly, which is alſo the caſe with large rivers; and therefore only a ſmall quantity of ground can be overflowed by them in compariſon of what can be done in other caſes; but the water of large rivers is generally poſſeſſed of more fertilizing properties than that of rivulets. In many caſes, however, the rivers are navigable, or have mills upon them: both of which are ſtrong objections to the perfect improvement of lands adjacent to them. From theſe conſiderations, our author concludes, that the watering of lands may be performed in the beſt and leaſt expenſive manner by ſmall rivulets and ſprings.

There are three kinds of ſoils commonly found near the banks of rivers and rivulets, the melioration of which may be attempted by watering. 1. A gravelly or ſound warm firm ſoil, or a mixture of the two together. This receives an almoſt inſtantaneous improvement; and the faſter the water runs over it the better. 2. Boggy, miry, and ruſhy ſoils, which are always found by the banks of rivers where the land is nearly level. Theſe alſo are greatly improved by watering; perhaps equally ſo with thoſe already deſcribed, if we compare the value of both in their unimproved ſtate, this kind of ground being ſcarce worth any thing in its unimproved ſtate. By proper watering, however, it may be made to produce large crops of hay, by which horned cattle may be kept through the winter and greatly forwarded; though in its uncultivated ſtate, it would ſcarce produce any thing to maintain ſtock in the winter, and very little even in ſummer. Much more ſkill, as well as expence, however, is requiſite to bring this kind of land into culture than the former. 3. The ſoils moſt difficult to be improved are ſtrong, wet, and clay ſoils; and this difficulty is occaſioned both by their being commonly on a dead level, which will not admit of the water running over them; and by their tenacity, which will not admit of draining. Even when the utmoſt care is taken, unleſs a ſtrong body of water is thrown over them, and that from a river the water of which has a very fertilizing property, little advantage will be gained; but wherever ſuch advantages can be had in the winter, and a warm ſpring ſucceeds, theſe lands will produce very large crops of graſs.

7
Springs and rivulets preferable to large rivers.

The advantage of uſing ſprings and rivulets for watering inſtead of large rivers is, that the expence of raiſing wares acroſs them will not be great; nor are they liable to the other objections which attend the uſe of large rivers. When they run through a cultivated country alſo, the land floods occaſioned by violent rains frequently bring with them ſuch quantities of manure as contribute greatly to fertilize the lands, and which are totally loſt where the practice of watering is not in uſe.

Springs may be uſeful to the coarſe lands that lie near them, provided the water can be had in ſufficient quantity to overflow the lands. "By ſprings (ſays our author), are not here meant ſuch as riſe out of poor heath and boggy lands (for the water iſſuing from them is generally ſo ſmall in quantity, and always ſo very lean and hungry in quality, that little if any advantage can be derived from it); but rather the heads of rivulets and brooks riſing out of a chalky and

gravelly

gravelly ſound firm ſoil, in a cultivated country. Theſe are invaluable; and every poſſible advantage ſhould be taken to improve the ground near them. The author knows a conſiderable tract of meadow-land under this predicament; and one meadow in particular that is watered by ſprings iſſuing immediately out of ſuch a ſoil, without any advantage from great towns, &c. being ſituated but a ſmall diſtance below the head of the rivulet, and the rivulet itſelf is fed all the way by ſprings riſing out of its bed as clear as cryſtal. The ſoil of the meadow is a good loam ſome inches deep, upon a fine ſpringy gravel. Whether it is from the heat of the ſprings, or whether the friction by the water running over the ſoil raiſes a certain degree of warmth favourable to vegetation, or from whatever cauſe it ariſes, the fecundity of this water is beyond conception; for when the meadow has been property watered and well drained, in a warm ſpring, the graſs has been frequently cut for hay within five weeks from the time the ſtock was taken out of it, having eat it bare to the earth; almoſt every year it is cut in ſix weeks, and the produce from one to three waggon loads to an acre. In land thus ſituated, in the mornings and evenings in the months of April, May, and June, the whole meadow will appear like a large furnace; ſo conſiderable is the ſteam or vapour which ariſes from the warmth of the ſprings acted upon by the ſun-beams; and although the water is ſo exceeding clear, yet upon its being thrown over the land only a few days in warm weather, by dribbling through the graſs, ſo thick a ſcum will ariſe and adhere to the blades of the graſs, as will be equal to a conſiderable quantity of manure ſpread over the land, and (it may be preſumed from the good effects) ſtill more enriched.

“ It is inconceivable what 24 hours water properly conveyed over the lands will do in ſuch a ſeaſon; a beautiful verdure will ariſe in a few days where a parched ruſty ſoil could only be ſeen; and one acre will then be found to maintain more ſtock than ten could do before.”

8
Explanation of the terms uſed in watering.

Mr Boſwell next proceeds to an explanation of the terms uſed in this art; of the inſtruments neceſſary to perform it; and of the principles on which it is founded. The terms uſed are:

1. A Ware. This is an erection acroſs a brook, rivulet, or river, frequently conſtructed of timber, but more commonly of bricks or ſtones and timber, with openings to let the water paſs, from two to ten in number according to the breadth of the ſtream, the height being always equal to the depth of the ſtream compared with the adjacent land. The uſe of this is occaſionally to ſtop the current, and to turn it aſide into the adjacent lands.

2. A Sluice is conſtructed in the ſame manner as a ware; only that it has but a ſingle paſſage for the water, and is put acroſs ſmall ſtreams for the ſame purpoſes as a ware.

3. A Tkunk is deſigned to anſwer the ſame purpoſes as a ſluice; but being placed acroſs ſuch ſtreams as either cattle or teams are to paſs over, or where it is neceſſary to carry a ſmall ſtream at right angles to a large one to water ſome lands lower down, is for theſe reaſons made of timber, and is of a ſquare figure. The length and breadth are various as circumſtances determine.

4. A Carriage is made of timber or of brick. If of timber, oak is the beſt: if of brick, an arch ought to be thrown over the ſtream that runs under it, and the ſides bricked up: But when made of timber, which is the moſt common material, it is conſtructed with a bottom and ſides as wide and high as the main in which it lies. It muſt be made very ſtrong, cloſe, and well-jointed. Its uſe is to convey the water in one main over another, which runs at right angles to it; the depth and breadth are the ſame with thoſe of the main to which it belongs; and the length is determined by that which it croſſes. The carriage is the moſt expenſive inſtrument belonging to watering.

5. A Drain-Sluice, or *Drain-Trunk*, is always placed in the lower part of ſome main as near to the head as a drain can be found; that is, ſituated low enough to draw the main, &c. It is made of timber, of a ſquare figure like a trunk, only much ſmaller. It is placed with its mouth at the bottom of the main, and let down into the bank; and from its other end a drain is cut to communicate with ſome trench drain that is neareſt. The dimenſions are various, and determined by circumſtances. The uſe of it is, when the water is turned ſome other way, to convey the leaking water that oozes through the hatches, &c. into the drain, that otherwiſe would run down into the tails of thoſe trenches which lie loweſt, and there poach and rot the ground, and probably contribute not a little to the making it more unſound for ſheep. This operation is of the utmoſt conſequence in watering; for if the water be not thoroughly drained off the land, the ſoil is rotted; and when the hay comes to be removed, the wheels of the carriage ſink, the horſes are mired, and the whole load ſometimes ſticks faſt for hours together. On the other hand, when the drain-trunks are properly placed, the ground becomes firm and dry, and the hay is ſpeedily and eaſily removed.

7. Hatches are beſt made of oak, elm, or deal; the uſe of them is to fit the openings of wares, trunks, or ſluices; and to keep back the water when neceſſary, from paſſing one way, to turn it another. They ought to be made to fit as cloſe as poſſible. When hatches belong to wares that are erected acroſs large ſtreams, or where the ſtreams ſwell quickly with heavy rains, when the hatches are in their places to water the meadows; they are ſometimes made ſo, that a foot or more of the upper part can be taken off, ſo that vent may be given to the ſuperfluous water, and yet enough retained for the purpoſe of watering the meadows. In this caſe, they are called *flood-hatches;* but Mr Boſwell entirely diſapproves of this conſtruction, and recommends them to be made entire, though they ſhould be ever ſo heavy, and require the aſſiſtance of a lever to raiſe them up. For when the water is very high, and the hatches are ſuddenly drawn up, the water falls with great force upon the bed of the ware, and in time greatly injures it; but when the whole hatch is drawn up a little way, the water runs off at the bottom, and does no injury.

3. A Head-Main, is a ditch drawn from the river, rivulet, &c. to convey the water out of its uſual current,

current, to water the lands laid out for that purpoſe, by means of leſſer mains and trenches. The head-main is made of various dimenſions according to the quantity of land to be watered, the length or deſcent of it, &c. Smaller mains are frequently taken out of the head one; and the only difference is in point of ſize, the ſecondary mains being much ſmaller than the other. They are generally cut at right angles, or nearly ſo with the other, though not invariably. The uſe of the mains, whether great or ſmall, is to feed the trenches with water, which branch out into all parts of the meadow, and convey the water to float the land. By ſome, theſe ſmaller mains are improperly called *Carriages*.

9. A TRENCH is a ſmall ditch made to convey the water out of the mains for the immediate purpoſe of watering the land. It ought always to be drawn in a ſtraight line from angle to angle, with as few turnings as poſſible. It is never deep, but the width is in proportion to the length it runs, and the breadth of the plane between that and the trench-drain. The breadth tapers gradually to the lower end.

10. A TRENCH-DRAIN is always cut parallel to the trench, and as deep as the tail-drain water will admit, when neceſſary. It ought always, if poſſible, to be cut down to a ſtratum of ſand, gravel, or clay. If in the latter a ſpade's depth into it will be of great advantage. The uſe of it is to carry away the water immediately after it has run over the panes from the trench. It need not be drawn up to the head of the land by five, ſix, or more yards, according to the nature of the ſoil. Its form is directly the reverſe of the trench; being narrower at the head, and growing gradually wider and wider until it empties itſelf into the tail-drain.

11. The TAIL-DRAIN is deſigned as a receptacle for all the water that flows out of the other drains, which are ſo ſituated that they cannot empty themſelves into the river. It ſhould run, therefore, nearly at right angles with the trenches, though generally it is thought moſt eligible to draw it in the loweſt part of the ground, and to uſe it to convey the water out of the meadows at the place where there is the greateſt deſcent; which is uſually in one of the fence-ditches: and hence a fence-ditch is uſually made uſe of inſtead of a tail-drain, and anſwers the double purpoſe of fencing a meadow and draining it at the ſame time.

12. A PANE ground, is that part of the meadow which lies between the trench and the trench-drain; and in which the graſs grows for hay. It is watered by the trenches, and drained by the trench-drains; whence there is a pane on each ſide of every trench.

13. A WAY-PANE is that part of the ground which lies in a properly watered meadow, on the ſide of the main where no trenches are taken out, but is watered the whole length of the main over its banks. A drain for carrying off the water from this pane runs parallel to the main. The uſe is to convey the hay out of the meadows, inſtead of the teams having to croſs all the trenches.

14. A BEND is made in various parts of thoſe trenches which have a quick deſcent, to obſtruct the water. It is made, by leaving a narrow ſtrip of green ſward acroſs the trench where the bend is intended to be left; cutting occaſionally a piece of the ſhape of a wedge out of the middle of it. The uſe is to check the water, and force it over the trench into the panes; which, were it not for theſe bends, would run rapidly on in the trench, and not flow over the land as it paſſes along. The great art in watering conſiſts in giving to each part of the pane an equal proportion of water.

15. A GUTTER is a ſmall groove cut out from the tails of theſe trenches where the panes run longer at one corner than the other. The uſe is to carry the water to the extreme point of the pane. Thoſe panes which are interſected by the trench and tail-drains, meeting in an obtuſe angle, require the aſſiſtance of gutters to convey the water to the longeſt ſide. They are likewiſe uſeful when the land has not been ſo well levelled, but ſome parts of the panes lie higher than they ought: in which caſe, a gutter is drawn from the trench over that high ground, which otherwiſe would not be overflowed. Without this precaution, unleſs the flats be filled up (which ought always to be done when materials can be had to do it) the water will not riſe upon it; and after the watering ſeaſon is paſt, thoſe places would appear ruſty and brown, while the reſt is covered with beautiful verdure. Our author, however, is of opinion, that this method of treating water-meadows ought never to be followed; but that every inequality in water-meadows ſhould either be levelled or filled up. Hence the waterman's ſkill is ſhown in bringing the water over thoſe places to which it could not naturally riſe, and in carrying it off from thoſe where it would naturally ſtagnate.

16. A CATCH-DRAIN is ſometimes made uſe of when water is ſcarce. When a meadow is pretty long, and has a quick deſcent, and the water runs quickly down the drains, it is cuſtomary to ſtop one or more of them at a proper place, till the water flowing thither riſes ſo high as to ſtrike back either into the tail-drains ſo as to ſtagnate upon the ſides of the panes, or till it flows over the banks of the drains and waters the grounds below, or upon each ſide. It is then to be conveyed over the land in ſuch quantity as is thought proper, either by a ſmall main, out of which trenches are to be cut with their proper drains, or by trenches taken properly out of it. In caſe of a ſtagnation, the deſign will not ſucceed; and it will then be neceſſary to cut a paſſage to let the ſtagnating water run of. Even when the method ſucceeds beſt, Mr Boſwell is of opinion, that it is not by any means eligible; the water having been ſo lately ſtrained over the ground that it is ſuppoſed by the watermen not to be endowed with ſuch fertilizing qualities as at firſt; whence nothing but abſolute neceſſity can juſtify the practice.

17. A POND is any quantity of water ſtagnating upon the ground, or in the tail-drain, trench-drains, &c. ſo as to annoy the ground near them. It is occaſioned ſometimes by the flats not having been properly filled up; at others, when the ware not being cloſe ſhut, in order to water ſome grounds higher up, the water is thereby thrown back upon the ground adjacent.

18. A TURN of water ſignifies as much ground as can be watered at once. It is done by ſhutting down

the hatches in all thoſe wares where the water is intended to be kept out, and opening thoſe that are to let the water through them. The quantity of land to be watered at once muſt vary according to circumſtances; but Mr Boſwell lays down one general rule in this caſe, viz. that no more land ought to be kept under water at one time than the ſtream can ſupply regularly with a ſufficient quantity of water; and if this can be procured, water as much ground as poſſible.

19. The HEAD of the meadow, is that part of it into which the river, main, &c. firſt enter.

20. The TAIL is that part out of which the river, &c. laſt paſſes.

21. The UPPER SIDE of a main or trench, is that ſide which (when the main or trench is drawn at right angles, or nearly ſo, with the river) fronts the part where the river entered. The lower ſide is the oppoſite.

22. The UPPER PANE in a meadow, is that which lies on the upper ſide of the main or trench that is drawn at right angles with the river: where the river runs north and ſouth, it enters in the former direction, and runs out in the ſouthern, the main and trenches running eaſt and weſt. Then all thoſe panes which lie on the north ſide of the mains are called *upper* panes; and thoſe on the ſouth ſide the *lower* panes. But when the mains, trenches, &c. run parallel to the river, there is no diſtinction of panes into upper and lower,

The inſtruments uſed in watering meadows are:

1. A *Water-Level.* The uſe of this is to take the level of the land at a diſtance, and compare it with that of the river, in order to know whether the ground can be overflowed by it or not. The inſtrument, however, is uſeful only in large undertakings; for ſuch as are on a ſmaller ſcale, the workmen diſpenſe with it in the following manner: In drawing a main, they begin at the head, and work deep enough to have the water follow them. In drawing a tail-drain, they begin at the lower end of it and work upwards. to let the tail-water come after them. By this method we obtain the moſt exact level.

2. The *Line, Reel,* and Breaſt-*Plough,* are abſolutely neceſſary. The line ought to be larger and ſtronger than that uſed by gardeners.

3. *Spades.* Theſe uſed in watering-meadows are made of a particular form, on purpoſe for the work; having a ſtem conſiderably more crooked than thoſe of any other kind. The bit is iron, about a foot wide in the middle, and terminating in a point: a thick ridge runs perpendicularly down the middle, from the ſtem almoſt to the point. The edges on both ſides are drawn very thin, and being frequently ground and whetted, the whole ſoon becomes narrow; after which the ſpades are uſed for trenches and drains; new ones being procured for other purpoſes. The ſtems being made crooked, the workmen ſtanding in the trench or drain are enabled to make the bottoms quite ſmooth and even.

4. *Wheel* and *Hand barrows.* The former are uſed for removing the clods to the flat places, and are quite open, without any ſides or hinder part. The latter are of ſervice where the ground is too ſoft to admit the uſe of wheel-barrows, and when clods are to be removed during the time that the meadow is under water.

5. *Three-wheeled carts* are neceſſary when large quantities of earth are to be removed; particularly when they are to be carried to ſome diſtance.

6. Short and narrow *Scythes* are made uſe of to mow the weeds and graſs, when the water is running in the trenches, drains, and mains.

7. *Forks,* and long *Crooks* with four or five tines, are uſed for pulling out the roots of ſedge, ruſhes, reeds, &c, which grow in the large mains and drains. The crooks ſhould be made light, and have long ſtems to reach wherever the water is ſo deep that the workmen cannot work in it.

8. Strong *Water-boots,* the tops of which will draw up half the length of the thigh, are indiſpenſably neceſſary. They muſt alſo be large enough to admit a quantity of hay to be ſtuffed down all round the legs, and be kept well tallowed to reſiſt the running water for many hours together.

9
Principles on which the practice of watering depends.

The principles on which the practice of watering meadows depend are few and eaſy.

1. Water will always riſe to the level of the receptacle out of which it is originally brought.

2. There is in all ſtreams a deſcent greater or ſmaller; the quantity of which is in ſome meaſure ſhown by the running of the ſtream itſelf. If it runs ſmooth and ſlow, the deſcent is ſmall; but if rapidly and with noiſe, the deſcent is conſiderable.

3. Hence if a main be taken out of the river high enough up the ſtream, water may be brought from that river to flow over the land by the ſide of the river, to a certain diſtance below the head of the main, although the river from whence it is taken ſhould, oppoſite to that very place, be greatly under it.

4 Water, ſunk under a carriage which conveys another ſtream at right angles over it, one, two, or more feet below its own bed, will, when it has paſſed the carriage, riſe again to the level it had before.

5. Water conveyed upon any land, and there left ſtagnant for any length of time, does it an injury; deſtroying the good herbage, and filling the place with ruſhes, flags, and other weeds.

6. Hence it is abſolutely neceſſary, before the work is undertaken, to be certain that the water can be thoroughly drained off.

10
Wright's method.

In Mr Wright's treatiſe upon this ſubject, the author conſiders a ſolution of the three following queſtions as a neceſſary preliminary to the operation of watering. 1. Whether the ſtream of water will admit of a temporary dam or ware acroſs it? 2. Can the farmer raiſe the water by this means a few inches above its level, without injuring his neighbour's land? 3. Can the water be drawn off from the meadow as quick as it is brought on?—If a ſatisfactory anſwer can be given to all theſe queſtions, he directs to proceed in the following manner.

Having taken the level of the ground, and compared it with the river, as directed by Mr Boſwell, cut a deep wide ditch as near the dam as poſſible, and by it convey the water directly to the higheſt part of the meadow; keeping the ſides or banks of the ditch of an equal height, and about three inches higher than the general ſurface of the meadow. Where the meadow is large, and has an uneven ſurface, it will ſometimes be neceſſary to have three works in different directions, each five feet wide, if the meadow contains 15 acres, and if the higheſt part be fartheſt from the ſtream. A ditch of 10 feet wide and three deep will commonly water 10 acres of land. When there are three works in a meadow, and flood-hatches at the mouth of each, when the water is not ſufficient to cover the whole complete at once, it may be watered at three different times, by taking out one of the hatches, and keeping the other two in. In this caſe, when the water has run over one diviſion of the land for 10 days, it may then be taken off that and tumbled over to another, by taking up another hatch and letting down the former; by which means the three diviſions will have a proper ſhare of the water alternately, and each reap equal benefit. The bottom of the firſt work ought to be as deep as the bottom of the river, when the fall in the meadow will admit of it; for the deeper the water is drawn, the more mud it carries along with it. From the works, cut, at right angles, ſmaller ditches or troughs, having a breadth proportioned to the diſtance to which ſome part of the water is to be carried, their diſtance from each other being about 12 yards. A trough two feet wide and one foot deep, will water a ſurface 12 yards wide and 40 feet long. In each trough as well as ditch place frequent ſtops and obſtructions, eſpecially when the water is rapid, to keep it high enough to flow through the notches or over the ſides. Each ditch and trough is gradually contracted in width, as the quantity of water conſtantly decreaſes the farther they proceed. Between every two troughs, and at an equal diſtance from both, cut a drain as deep as you pleaſe parallel to them, and wide enough to receive all the water that runs over the adjacent lands, and to carry it off into the maſter-drain with ſuch rapidity as to keep the whole ſheet of water in conſtant motion; and if poſſible, not to ſuffer a drop to ſtagnate upon the whole meadow. "For a ſtagnation, ſays he, (though it is recommended by a Mr D. Young for the improvement of arable land), is what we never admit in our ſyſtem of watering; for we find that it rots the turf, ſoaks and ſtarves the land, and produces nothing but coarſe graſs and aquatic weeds.

"When a meadow lies cold, flat, and ſwampy, the width of the bed, or the diſtance between the trough and drain, ought to be very ſmall, never exceeding ſix yards: indeed, in this caſe, you can ſcarcely cut your land too much, provided the water be plentiful; for the more you cut, the more water you require. The fall of the bed in every meadow ſhould be half an inch in a foot: leſs will do, but more is deſirable; for when the draught is quick, the herbage is always fine and ſweet. The water ought never to flow more than two inches deep, nor leſs than one inch, except, in the warm months."

11
Objections to his method anſwered.

Mr Wright proceeds now to anſwer ſome objections made by the Reviewers in their account of the firſt edition of his work, 1. That the Glouceſterſhire farmers uſe more water for their lands than is neceſſary. To this it is anſwered, That where water is plentiful, they find it advantageous to uſe even more water than he recommends; and when water is ſcarce, they chooſe rather to water only one half, or even a ſmaller portion of a meadow at a time, and to give that a plentiful covering, than to give a ſcanty one to the whole. 2. The Reviewers likewiſe recommend a repeated uſe of the ſame water upon different and lower parts of the ſame meadow, or to make each drain ſerve as a trough to the bed which is below it. But tho' this method is in ſome degree recommended by the celebrated Mr Bakewell, and taught by a ſyſtematic waterer in Staffordſhire, he entirely diſapproves of it; excepting where the great declivity of the land will not admit of any other plan. "This cannot (ſays he) be a proper mode of watering graſs-land in the winter-time; for it can be of no ſervice to the loweſt parts of the meadow, unleſs as a wetting in ſpring or ſummer. The firſt or higheſt part of a meadow laid out according to this plain will indeed be much improved; the ſecond may reap ſome benefit; but the third, which receives the exhauſted thin cold water, will produce a very unprofitable crop. Our farmers never chooſe more than a ſecond uſe in the ſame meadow, and that very ſeldom; they call even the ſecond running by the ſignificant name of *ſmall-beer*; which, they ſay, may poſſibly ſatisfy thirſt, but can give very little life or ſtrength to land (A). It is a much better method to have a meadow laid out ſo as to be watered at ſeveral

12
A repeated uſe of the ſame water is not eligible.

(A) As by the concurrence of Mr Boſwell with this author, and likewiſe by the agreement of ſo many practical farmers, it ſeems eſtabliſhed as a fact, that water does really loſe its fertilizing properties by running over graſs, it may not here be amiſs to explain the principle on which it does ſo.

Under the article Agriculture, we have ſhown at ſome length, that the true food of plants is the parts of animal and vegetable ſubſtances diſſolved and volatalized by putrefaction, in ſuch a manner that they can be abſorbed by the veſſels of other plants, and thus become part of their ſubſtance. There are two ways in which theſe effluvia may be diſſolved, viz. in air and in water; of conſequence, air and water are the two media by which the food of plants is applied to them, and by means of which they are augmented in bulk. From the analyſis of theſe two elements, it is known that both of them, at leaſt in their ordinary ſtate, contain a great quantity of volatilized earthy matter, which ſometimes ſtrikes our ſenſes very forcibly when firſt emitted by putrefying bodies; but on being thoroughly diſſolved by the atmoſphere, it totally eludes them, and becomes the Phlogiston concerning which ſuch violent diſputes have ariſen. This fine votalized matter is abſorbed from the atmoſpere by the leaves of the plants, and from the water by their roots. Hence both elements, when loaded with vapours of this kind, are more favourable to vegetation than when in their pure ſtate. Thus plants will thrive very well in putrid air, while they languiſh and die in the pure dephlogiſticated kind. Juſt ſo it is with the element of water. When this is loaded with a great quantity of putrid matter, it readily parts with it not only to the roots of plants, but to the atmoſphere alſo; whence ſuch vegetables as it has veral times, and to be at the expence of ſeveral ſmall flood-hatches, than to water the whole of it at once by means of catch-drains.

"Sometimes it is neceſſary, in a large meadow, to convey the water that has been uſed under the works and troughs; and then the water above is ſupported by means of boards and planks, which we call a *carry-bridge*. Sometimes, the better to regulate the courſe of the water on the ſurface, eſpecially in the ſpring, narrow trenches are dug, and the mould laid by the ſide of them, in order to be reſtored to its former place when the watering is finiſhed. The earth and mud thrown out in cleanſing and paring the ditches ſhould be carried to fill up the low hollow parts of the meadow, and be trodden down with an even ſurface; which will eaſily be done when the water is on, the waterman being always provided with a ſtrong pair of water-proof boots. If the mould thus uſed has upon it a turf that is tolerably fine, place it uppermoſt; but if it is ſedgy and coarſe, turn it under, and the water if it runs quick will ſoon produce a fine herbage upon it.

"The grounds that are watered in the eaſieſt and moſt effectual manner, are ſuch as have been ploughed and ridged up in lands about twelve yards wide. Here the water is eaſily carried along the ridge by means of a ſmall ditch or trough cut along its ſummit, and then, by means of the ſtops in it, is made to run down the ſides or beds into the furrows, by which it is carried into the maſter drain, which empties itſelf into the river. Every meadow, before it is well watered, muſt be brought into a form ſomething like a field that has been thus left by the plough in a ridged ſtate. Each ſide of the ridge ſhould be as nearly as poſſible an exact inclined plane, that the water may flow over it as equally as may be." Mr Wright does not, like Mr. Boſwell, diſapprove of the uſe of flood-hatches; he only gives the following hint, viz. that their baſis ſhould be deep and firmly fixed, well ſecured with ſtone and clay, that it be not blown up. The following directions are given for each month of watering:

13
Of cleaning and repairing the works.

14
Thick and muddy water to be uſed when it can be done.

In the beginning of November, all the ditches, troughs, and drains, are to be thoroughly cleanſed by the ſpade and breaſt-plough, from weeds, graſs, and mud; and well repaired, if they have received any injury from cattle. After a ſhower, when the water is thick and muddy, turn over the meadow as much water as you can without injuring the banks of the works, eſpecially if the land be poor; as in this month, according to our author, the water contains many more fertilizing particles, which he calls *ſalts* and *richneſs*, than later in the winter. In defence of this poſition, of which it ſeems the Monthly Reviewers have doubted, our author urges, that though he is not able to prove it by any chemical analyſis, yet it ſeems evident, that "after the firſt waſhing of farm yards, various ſinks, ditches, and the ſurface of all the adjoining fields, which have lain dry for ſome time, the common ſtream ſhould then contain much more fatneſs than when the ſame premiſſes have been repeatedly waſhed." This is confirmed by the experience of the Glouceſterſhire farmers; who, if they can at this ſeaſon of the year procure plenty of muddy water to overflow their grounds for one week, look upon it to be equally valuable with what is procured during all the reſt of the winter. In ſupport of this, he quotes the following words of Mr Forbes, in a treatiſe on watering: "The water ſhould be let in upon the meadow in November, when the firſt great rains make it muddy, for then it is full of a rich ſediment, brought down from the lands of the country through which it runs, and is waſhed into it by the rain; and as the ſediment brought by the firſt floods is the richeſt, the carriages and drains of the meadow ſhould all be ſcoured clean and in order, before theſe floods come."

"In oppoſition (adds Mr Wright) to the opinion of practical waterers, that the muddineſs of the water is of little conſequence, I heſitate not to affirm, that the mud is of as much conſequence in winter-watering, as dung is in the improvement of a poor upland field. For each meadow in this neighbourhood is fruitful in proportion to the quantity of mud that it collects from the water. And, indeed, what can be conceived more enriching than the abundant particles of putrid matter which float in the water, and are diſtributed over the ſurface of the land, and applied home to the roots of the graſs. It is true, that any the moſt ſimple water thrown over a meadow in proper quantity, and not ſuffered to ſtagnate, will ſhelter it in winter, and in the warmth of ſpring will force a crop; but this unuſual force muſt exhauſt the ſtrength of the land, which will require an annual ſupply of manure in ſubſtance, or in a courſe of years, the ſoil will be impaired rather than improved. The meadows in this county, which lie next below a market-town or village, are invariably the beſt; and thoſe which receive the water after it has been two or three times uſed, reap proportionably leſs benefit from it: For every meadow that is well laid, and has any quantity of graſs upon its ſurface, will act as a fine ſieve upon the water, which, though it flow in ever ſo muddy, will be returned back to the ſtream as clear as it came from the fountain. This circumſtance, when there is a range of meadows to be watered, the property of different perſons, when water is ſcarce, creates vehement contentions and ſtruggles for the firſt uſe of it. The proprietors are therefore compelled to agree among themſelves, either to have the firſt uſe alternately, or for the higher meadows to dam up, and uſe only one half or a leſs portion of the river. Our farmers know

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has acceſs to, arrive at the utmoſt luxuriance of growth. If the water is more pure, ſtill they will thrive very well; but the luxuriance of vegetation is leſs than in the former caſe. At laſt, however, when the water has parted with a certain quantity of phlogiſtic matter, the proceſs of vegetation is incapable of ſeparating any more; and therefore ſuch water, though applied to the roots of vegetables, cannot communicate to them any remarkable increaſe. Nay, it is by no means improbable, that after water has arrived at this ſtate, it will, inſtead of giving any freſh nouriſhment to the plants, again deprive them of the nouriſhment which they have already received; and this is probably what Mr Boſwell means, when, in the paſſage formerly quoted, he calls the water *hungry*.

know the mud to be of ſo much conſequence in watering, that whenever they find it collected at the bottom of the river or the ditches, they hire men whole days to diſturb and raiſe it with rakes made for the purpoſe, that it may be carried down by the water, and ſpread upon their meadows. One meadow in South Cerney, I think, is an inconteſtible proof of the conſequence of muddy water. It is watered by a branch of the common ſtream that runs for about half a mile down a public road. This water, by the mud on the road being continually diſturbed by carriages and the feet of cattle, becames very thick, and when it enters the meadow is almoſt as white as milk. This field, which conſiſts of ſeven acres, was a few years ago let for 10 s. an acre, but is already become the richeſt land in the pariſh, and has produced at one crop eighteen loads of hay, and each load more than 25 hundred weight."

15
Inſtance of the good effects of muddy water.

16
Mr Wimpey's opinion upon the ſubject.

In further confirmation of what our author aſſerts, he quotes, from the Annals of Agriculture, the following words of Mr Wimpey: "As to the ſorts of water, little is to be found, I believe, which does not encourage and promote vegetation, even the moſt ſimple, elementary, and uncompounded fluid: heat and moiſture, as well as air, are the *ſine qua non* of vegetation as well as animal life. Different plants require different proportions of each to live and flouriſh; but ſome of each is abſolutely neceſſary to all. However, experience as well as reaſon univerſally ſhows, that the more turbid, feculent, and replete with putreſcent matter the water is, the more rich and fertilizing it proves. Haſty and impetuous rains of continuance ſufficient to produce a flood, not only diſſolve the ſalts, but waſh the manure in ſubſtance off the circumjacent land into the rapid current. Such turbid water is both meat and drink to the land; and, by the unctuous ſediment and mud it depoſits, the ſoil is amazingly improved and enriched. The virtue of water from a ſpring, if at all ſuperior to pure elementary water, is derived from the ſeveral ſtrata or beds of earth it paſſes through, that, according to the nature of ſuch ſtrata, it may be friendly or otherwiſe to vegetation. If it paſſes through chalk, marle, foſſil ſhells, or any thing of a calcareous nature, it would in moſt ſoils promote the growth of plants; but if through metallic ores, or earth impregnated with the vitriolic acid, it would render the land unfertile, if not wholly barren. In general the water that has run far is ſuperior to that which immediately flows from the ſpring, and more eſpecially that which is feculent and muddy, conſiſting chiefly of putrid animal ſubſtances waſhed down the ſtream."

17
Confirmed by Mr Forbes.

To the ſame purpoſe alſo ſays Mr Forbes: "There is great difference in the quality of water, ariſing from the particles of different kinds of matter mixed with them. Thoſe rivers that have a long courſe through good land are full of fine particles, that are highly fertilizing to ſuch meadows as are uſually overflowed by them; and this chiefly in floods, when the water is fulleſt of a rich ſediment: for when the water is clear, though it may be raiſed by art high enough to overflow the adjoining lands, and be of ſome ſervice to them, the improvement thus made is far ſhort of what is obtained from the ſame water when it is thick and muddy."

18
Mr Boſwell's opinion.

Mr Boſwell, though quoted by Mr Wright as an advocate for the doctrine juſt now laid down, ſeems, in one part of his work at leaſt, to be of a contrary opinion. This is in the 14th chapter of his book, where he remarks upon another publication on the ſame ſubject, the name of which he does not mention: "In page 4th of that pamphlet (ſays Mr Boſwell), the writer informs us, 'if the water uſed be always pure and ſimple, the effect will by no means be equal to the above: that is, of a ſtream that is ſometimes thick and muddy. We have a ſtriking inſtance of this in two of our meadows, which are watered immediately from ſprings that ariſe in the grounds themſelves. Their crops are early and plentiful, but not of a good quality, and the land remains unimproved after many years watering.'

"The writer of this treatiſe (Mr Boſwell), in a former edition, had aſſerted, and in this repeated, the contrary effects from a ſtream very near the ſpring-head, as clear as cryſtal.

"The gentleman (Mr Beverly of Keld) whom that writer mentions in his preface, made a ſhort viſit laſt ſpring into Dorſetſhire, to ſatisfy himſelf of the fact. The editor had the pleaſure to ſhow him the ſtream alluded to, which he traced almoſt to the fountain-head. It was perfectly clear, and the water was then immediately conveyed out of the ſtream upon the lands adjoining, ſome of which it was then running over; others it had been upon, and the verdure was then appearing. The gentleman expreſſed himſelf perfectly ſatisfied with the fact. To him the editor wiſhes to refer, &c. Mr George Culley of Fenton near Woler in Northumberland, with a truly noble and public ſpirit that does him great honour as a friend to his country, ſent a very ſenſible young man from thence into Dorſetſhire, to learn the art of watering meadows, and to work the whole ſeaſon in thoſe meadows under different watermen. This man was often over thoſe meadows, and worked in ſome juſt below that were watered by the ſame ſtream. Might the editor preſume to offer his opinion upon this ſeeming contradiction, it is very probable that the ſoils, both the upper and under ſtrata, are very different, as well as thoſe through which the different ſprings run."

19
Advantages of land-floods.

From this paſſage, the latter part of which is not very intelligible, we might conclude that Mr Boſwell prefers clear to muddy water for overflowing meadows. In this chapter on land-floods, however, he expreſſes himſelf as follows; "They will (ſays he) always be found of great uſe where the ſweeping of towns, farm-yards, &c. are carried down by them; ſeldom any other erection is wanting beſides a ſluice or ſmall ware to divert and convey them over the lands. If the ſituation of the lands happens to be on the ſide of a hill, catch-drains are abſolutely neceſſary for watering the lower part of the hill, after the water has been uſed upon the upper. In many parts of the kingdom, where there are large hills or extenſive riſing lands, great quantities of water run from them into the valleys after heavy rains: Theſe might with proper attention be collected together before they get to the bottom or flat ground, and from thence be diverted to the purpoſe of watering thoſe lands that lie below, with great advantage to the occupier, and at

20 Of converting arable land into paſture.

a ſmall expence. And ſhould the land thus ſituated be arable, yet it would be found a beneficial exchange to convert it into paſture; particularly if paſture-ground ſhould be a deſirable object to the occupier. The method of performing it is thus recommended. Obſerve the piece of land or field beſt adapted to the purpoſe, both for ſituation and ſoil. If it ſhould be arable, make it firſt very level; and with the crop of corn ſow all ſorts of hay ſeeds: and as ſoon as it has got a green ſward it may be laid out. In the loweſt part of the ground draw a deep ditch for the current to run in through it; and continue it into ſome ditch or low part in the lands below, that the water may be freely carried off, after it has been and while it is in uſe. Draw ditches above the field intended to be watered aſlant the ſides of the hill, in ſuch a manner that they may all empty themſelves into the head of the ditch abovementioned, juſt where it enters the field to be watered: then erecting a ware acroſs this ditch, the field will be capable of being watered according to the ſituation of the ditch in the middle or on the ſide of the field; It muſt then be conveyed by ſmall mains or trenches, and ſubdivided again by branch trenches, according to the ſite of the field and the quantity of water that can be collected; trench drains muſt be drawn, and the water conveyed into the ditch by means of tail-drains. A perſon unacquainted with water meadows cannot conceive the advantage ariſing from water thus collected and conveyed over this ſpecies of water-meadow (if it may be ſo called), being generally a firm good ſoil; for the water running down from rich cultivated hills, eminences, &c. ſweeps away with it, when the rain falls very heavy, vaſt quantities of dung dropped by ſheep and other cattle, and the manure carried upon arable lands; all which being now diverted, and carried over the meadow with an eaſy deſcent, gives time for the particles of manure to ſubſide upon the ground at one ſeaſon, or of being filtered from it as it dribbles through the graſs at another; after which the warm weather puſhes on vegetation amazingly. Meadows thus ſituated would be vaſtly ſuperior to any other, if they had the advantage of a conſtant ſtream: but even as they are, taking the opportunity of watering them by every heavy rain or flood that happens, they will be found to be very valuable. The occupier of ſuch lands is ſtrenuouſly adviſed to let no time be loſt in appropriating them to this uſe; becauſe theſe lands are healthy for all kinds of cattle at almoſt all ſeaſons; and the expence of converting them into this kind of water-meadow is exceedingly ſmall, the annual charges afterwards quite trifling, and the produce very conſiderable."

21 Mr Wright's directions for watering thro' the different months of the year.

Mr Wright having diſcuſſed the ſubject of the quality of the water, proceeds to give directions for watering through the different months of the year:—

" In December and January, the chief care conſiſts in keeping the land ſheltered by the water from the ſeverity of froſty nights. It is neceſſary, however, through the whole winter, every ten days or fortnight to give the land air, by taking the water off entirely, otherwiſe it would rot and deſtroy the roots of the graſs. It is neceſſary, likewiſe, that a proper perſon ſhould go over every meadow at leaſt twice every week, to ſee that the water is equally diſtributed, and to remove all obſtructions ariſing from the continual influx of weeds, leaves, ſticks, and the like. In February a great deal depends upon care and caution. If you now ſuffer the water to remain on the meadow for many days without intermiſſion, a white ſcum is raiſed, very deſtructive to the graſs; and if you take off the water, and expoſe the land to a ſevere froſty night, without its being previouſly dried for a whole day, the greateſt part of the tender graſs will be cut off. The only ways to avoid theſe two injuries are, either to take the water off by day to prevent the ſcum, and to turn it over again at night to guard againſt the froſt; or, if this practice be too troubleſome, both may be prevented by taking the water entirely off for a few days and nights, provided the firſt day of taking off be a dry one; for if the graſs experience one fine drying day, the froſt at night can do little or no injury. The ſcum is generated chiefly by the warmth of the ſun, when the water is thin and uſed too plentifully. Towards the middle of this month we vary our practice in watering, by uſing only about half the quantity of water which is made uſe of earlier in the winter, all that is now required being to keep the ground in a warm moiſt ſtate, and to force vegetation.

" At the beginning of March, the crop of graſs in the meadows is generally ſufficient to afford an abundant paſturage for all kinds of ſtock, and the water is taken off for near a week, that the land may become dry and firm before the heavy cattle are turned in.—It is proper, the firſt week of eating off the ſpring-feed, if the ſeaſon be cold, to give the cattle a little hay each night."

22 Of eating off the ſpring graſs with ewes and lambs.

" It is a cuſtom (ſays Mr Wright) with ſome farmers in Hampſhire, to eat of the ſpring-graſs of their meadows with ewes and lambs, in the ſame manner that we do a field of turnips, by incloſing a certain portion each day with hurdles or ſtakes, and giving them hay at the ſame time. This is certainly making the moſt of the graſs, and an excellent method to fine and ſweeten the future herbage. In this month and April, you may eat the graſs as ſhort and cloſe as you pleaſe, but never later; for if you treſpaſs only one week on the month of May, the hay-crop will be very much impaired, the graſs wil become ſoft and woolly, and have more the appearance and quality of an after-math than a crop. At the beginning of May, or when the ſpring feeding is finiſhed, the water is again uſed for a few days by way of wetting.

23 How watering may occaſion the rot in ſheep.

" It is rather remarkable, that watering in autumn, winter, or ſpring, will not produce that kind of herbage which is the cauſe of the rot in ſheep; but has been known to remove the cauſe from meadows, which before had that baneful effect. If, however, you uſe the water only a few days in any of the ſummer months, all the lands thus watered will be rendered unſafe for the paſturage of ſheep. Of this I was lately convinced from an experiment made by a friend. At the beginning of July, when the hay was carried off, and the water rendered extremely muddy and abundant by ſeveral days rain, he thought proper to throw it over his meadows for ten days, in which time a large collection of extremely rich manure was made upon the land. In about a month the meadow was covered with uncommon luxuriancy and blackneſs of herbage. Into this graſs were turned eight

eight ſound ewes and two lambs. In ſix weeks time the lambs were killed, and diſcovered ſtrong ſymptoms of rottenneſs, and in about a month afterwards one of the ewes was killed, and though it proved very fat, the liver was putrid and replete with the inſect called the *fluke* or *weevill:* the other ewes were ſold to a butcher, and all proved unſound. This experiment, however, convinces me, by the very extraordinary improvement made thereby in the meadow, that muddy water in the ſummer is much more enriching than it is in autumn or winter: and ought, therefore, to be uſed for a week at leaſt every wet ſummer, notwithſtanding its inconveniences to ſheep, the moſt profitable ſpecies of ſtock."

24
Mr Boſwell's general directions for watering.

Mr Boſwell, beſides his general directions for watering, gives many plans of the ditches, drains, &c. for particular meadows, ſome of them done from an actual ſurvey. But theſe being confined to particular ſituations, we ſhall here only ſpeak of his method in general. In his third chapter, intitled *A general Deſcription of water-meadows*, he obſerves, that "lands capable of being watered, lie ſometimes only on one ſide and ſometimes on both ſides of the ſtream deſigned to ſupply them with water. In the former caſe, when they have a pretty quick deſcent, the land may be often watered by a main drawn out of the ſtream itſelf, without any ware; though he acknowledges that it is by far the beſt way to erect a ware, and to draw mains on each ſide, to diſpoſe of the water to the beſt advantage.

Boggy lands require more and longer continued watering than ſuch as are ſandy or gravelly; and the larger the body of water that can be brought upon them, the better. The weight and ſtrength of the water will greatly aſſiſt in compreſſing the ſoil, and deſtroying the roots of the weeds that grow upon it nor can the water be kept too long upon it, particularly in the winter ſeaſon; and the cloſer it is fed, the better.

To improve ſtrong clay ſoils, we muſt endeavour to the utmoſt to procure the greateſt poſſible deſcent from the trench to the trench-drain; which is beſt done by making the trench-drains as deep as poſſible, and applying the materials drawn out of them to raiſe the trenches. Then, with a ſtrong body of water, taking the advantage of the autumnal floods, and keeping the water ſome time upon them at that ſeaſon, and as often as convenient during the winter, the greateſt improvement on this ſort of ſoils may be made. Warm ſand or gravelly ſoils are the moſt profitable under the watering ſyſtem, provided the water can be brought over them at pleaſure. In ſoils of this kind, the water muſt not be kept long at a time, but often ſhifted, thoroughly drained, and the land frequently refreſhed with it; under which circumſtances the profit is immenſe. A ſpring-feeding, a crop of hay, and two aftermaths, may be obtained in a year; and this probably, where in a dry ſummer ſcarce graſs enough could be found to keep a ſheep alive. If the ſtream be large, almoſt any quantity of land may be watered from it; and though the expence of a ware over it is great, it will ſoon be repaid by the additional crop. If the ſtream is ſmall, the expence will be ſo in proportion.

25
Method of improving a ſpungy water-meadow.

The following method of improving a water-meadow that was ſpringy has been tried by Mr Boſwell with ſucceſs. The meadow had been many years watered by a ſpring riſing juſt above it from a barren ſandy heath; the ſoil near the ſurface was in ſome places a gravelly ſand, in others a ſpongy cork, both upon a ſtrong clay and ſand mixture, which retained the draining of the lands above it. Whenever it had been watered, and left to drain itſelf dry, a yellowiſh-red water ſtood in many parts, and oozed out of others; the herbage being no other than a poor, miſerable, hairy graſs and ſmall ſedge. Chalk and aſhes had been thrown over it to very little purpoſe. It was then drained underground aſlant all the different deſcents, and all theſe drains carried into one large drain, which had been already cut for the purpoſe of carrying off the water when the meadow was overflowed. Theſe drains were cut quite through the mixture of clay and ſand, and as much deeper as the fall of the ground below would admit of; then, with chalk cut for the purpoſe, ſmall hollow drains were formed at the bottom of theſe; the drains were then filled up with the materials that came out.

This was done in the beginning of ſummer, and the work frequently examined through the ſeaſon; the ſoil was found firmer than before, and none of that naſty red water to be met with upon the ſurface, though it continually oozed into the drains. In autumn the meadow was again prepared for waterings, by repairing thoſe trenches and drains that were properly ſituated: cutting others where wanted, for the purpoſe of watering meadows. The water being then brought over it from the ſame ſpring as before, the event anſwered the moſt ſanguine wiſhes of the proprietor; the effects were viſible the firſt year, and the ground has been conſtantly improving ever ſince.

26
Of watering lands on the ſides of hills.

Mr Boſwell alſo informs us, that a gentleman in Scotland had applied to him for directions to water ſome lands lying on the ſides of hills, where the deſcent is quick; and of which there are many in this country as well as in the north of England. It would be difficult to water ſuch lands by means of drains and trenches according to the directions already given; becauſe the bends in the trenches muſt be very near together and large; as the water muſt flow out of the trench *above* the bend to flow over the pane below it; the number and ſize would likewiſe be inconvenient, and greatly offend the eye.

Lands of this ſort are generally capable of being ploughed; in which caſe our author directs them to be once ploughed in the ſpring, and ſown with oats or any other kind of grain that will rot the ſward. When the grain is harveſted, plough the land acroſs; the laſt ploughing with the Kentiſh plough, which has a moveable mold-board, and is called a *turn-wriſt* plough. This turns the furrows down the ſide of the hill, the horſes going forwards and backwards in the ſame furrows. By this means the land is laid flat without any open furrows in it; dreſs it down in the ſpring very fine, and ſow it with oats, and mix with ſome kinds of graſs ſeeds very thick. Thus the ground will have but few irregularities; and as ſoon as the corn is carried off, or the following ſpring at fartheſt, the mains and drains may be cut out.

For watering coarſe lands that are firm enough to bear the plough, and ſituated near a ſtream, our author gives the following directions.

27
Of watering coarſe lands.

“Let the land thus ſituated be ploughed once in the ſpring, and ſown with any grain that will rot ſward. As ſoon as the crop is off, plough it again, and leave it rough through the winter. Work it down early in the ſpring, and plough it in the direction the trenches are to lie, making the ridges of a proper ſize for watering, ten or twelve yards wide for inſtance; work it fine; then gather the ridges up again in the ſame manner, making the laſt furrows of each ridge as deep as poſſible. If the land be not fine, dreſs it down again, and gather it up a ſecond time if neceſſary; and with a ſhovel throw the earth from the edges of the furrows to the tops of the ridges, to give the greateſt poſſible deſcent from the trench to the drain. Sow it with oats and graſs ſeeds very thick; and after the corn is carried off, the trenches may be formed upon the top of each ridge, diſperſing the furrows with a ſpade as much as the fall of the land will admit of for the drains; taking care to procure ſufficient fall at all events, to drain the lands after they have been watered. By this method the crops of corn will nearly pay all the expence, and the land will be in excellent order.

28
Of the management of meadows after watering.

After the work of watering a meadow is totally finiſhed, and the hay carried off, cattle may be let in to eat the after-math. When this is done, it will then be neceſſary to examine whether or not the mains have ſuffered any injury from their feet; whether there be quantities of mud or ſand collected at the angles, &c. all of which muſt be thrown out and the breaches repaired; by which means the trenches, drains, &c. will laſt three years, but otherwiſe not more than two. The roots, mud, &c. may be uſed in repairing the breaches, but never left upon the ſides of the trenches out of which they are taken. The tail-drains require to be cleanſed oftener than any of the other works, for this obvious reaſon, that the mud, &c. is carried down from all the others into them; where if it be allowed to accumulate, it occaſions a ſtagnation of water upon the meadow itſelf. In repairing the trenches, particular care ought to be taken that the workmen do not make them any wider than before, which they are very apt to do: neither are they to be allowed to throw the materials which they dig out in a ridge behind the edge of the trench, which both widens it and promotes weeds.

29
Of the times the water ſhould continue upon the meadows.

During the time of watering, it will be neceſſary to examine the meadow every two or three days in order to remove obſtructions, &c. If the drains ſhould be filled with water and run over, they ought to be made deeper: or if this cannot be done, they ſhould be widened. In the winter time a regular ſtrong water ſhould be kept, avoiding very ſtrong great floods. In this ſeaſon the water may be kept on the ground with ſafety for a month or even ſix weeks if the ſoil be corky or boggy or a ſtrong clay; but not quite ſo long if it be gravel or ſand. At the ſecond watering a fortnight or three weeks will be ſufficient; and after Candlemas a fortnight will be rather too long. At the third watering a week will be ſufficient, which will bring it to about the middle of March; by which time if the weather be tolerably mild, the graſs will be long enough for the ewes and lambs, or fatting lambs; which may then be turned into the meadow with great advantage. Even in the end of February, if the winter has been very mild, the graſs will be long enough for them. Here they may be permitted to feed till the beginning of May, changing them into different meadows. As ſoon as they are taken out, the water muſt be turned in for a week, carefully examining every trench and drain for the reaſons already given. The water is then to be ſhifted into others, alternately watering and draining, leſſening the time the water remains upon it as the weather grows warmer; and in five, ſix, or ſeven weeks, the graſs will be fit to be mown for hay, and produce from one or two tons, or even more, an acre upon good ground.

Mr Boſwell directs, that about a week before the graſs is to be mown the water ſhould be let into the meadow for 24 hours; which, he ſays, will make the ground moiſt at the bottom, the ſcythe will go thro' it the more eaſily, and the graſs will be mown cloſer to the ground. This practice, however, is entirely diſapproved of by Mr Wright. “Though it may prevail in Dorſetſhire (ſays he), it is very ſeldom adviſable, for the following reaſons: Water made to run through a thick crop of graſs, though it may appear ever ſo pure, will leave a certain quantity of adherent ſcum or ſediment, which can never be ſeparated from the hay, but will render it unpalatable, if not prejudicial, to the cattle that eat it. And this wetting of the land and graſs will impede the drying or making of the hay perhaps ſome days, which in difficult ſeaſons is of very great conſequence; and it will likewiſe make the turf too ſoft and tender to ſupport the wheels of a loaded waggon in carrying off the hay. Beſides, there is reaſon to believe that one day's wetting in the ſummer will, upon moſt meadows, endanger the ſoundneſs of every ſheep that feeds upon the aftermath.”

30
Of ſpring-feeding.

The ſpring-feeding ought never to be done by heavier cattle than ſheep or calves; for larger cattle do much hurt by poaching the ground with their feet, deſtroying the trenches, and ſpoiling the graſs. Mr Boſwell likewiſe greatly recommends a proper uſe of ſpring floods, from which he ſays much benefit may be derived; but if there is any quantity of graſs in the meadows not eaten, theſe floods muſt be kept out, otherwiſe the graſs will be ſpoiled; for they bring with them ſuch quantities of ſand and mud, which ſtick to the graſs, that the cattle will rather ſtarve than taſte it. Great quantities of egraſs or aftermath are frequently ſpoiled in flat countries by the floods which take place in the fall. In the winter-time however, when the ground is bare, the ſand and mud brought down by the floods is ſoon incorporated with the ſoil, and becomes an excellent manure. The certain rule with regard to this matter is, “Make uſe of the floods when the graſs cannot be uſed: avoid them when the graſs is long or ſoon to be cut.”

31
Of watering from the end of autumn to Candlemas.

“It has often been a ſubject of diſpute (ſays Mr Boſwell), whether, from the latter end of autumn to Candlemas, the throwing a very ſtrong body of water, where it can be done, over the meadows, is of any eſſential ſervice or not? Thoſe who conſider it as advantageous, aſſert, that when the waters run rude and ſtrong over the ground, they beat down and rot the tufts of foggy rough graſs, ſedge, &c. that are always to be found in many parts of coarſe meadow-ground; and therefore are of peculiar ſervice to them. On the other ſide it is alleged, that by coming in ſo large a body, it beats the ground (in the weak places particularly) ſo bare, that the ſward is deſtroyed; and alſo brings with it ſuch quantities of ſeeds of weeds, that at the next hay ſeaſon the land in all thoſe bare places bears a large burden of weeds, but little graſs.

"The general opinion of the watermen upon this point is, that in water meadows which are upon a warm, ſandy, or gravelly ſoil, with no great depth of loam upon them, rude ſtrong watering, even in winter, always does harm without any poſſible eſſential ſervice. On the contrary, cold ſtrong clay land will bear a great deal of water a long time without injury: and boggy, corky, or ſpongy ſoil, will alſo admit of a very large and ſtrong body of water upon it; provided the drains are made wide and deep enough to carry it off, without forcing back upon the end of the panes, with great advantage for almoſt any length of time at that ſeaſon. The weight and force of the water vaſtly aſſiſts in compreſſing thoſe ſoils, which only want ſolidity and tenacity to make them produce great burthens of hay: nothing, in their opinion, corrects and improves thoſe ſoils ſo much as a very ſtrong body or water, kept a conſiderable time upon them at that ſeaſon."

Notwithſtanding the above reaſons, however, Mr Boſwell informs us, That he has doubts upon the ſubject; nor can he by any means acquieſce in this opinion, unleſs by rude ſtrong waters he is permitted to underſtand only rather a larger quantity of water conveyed over the land at this early ſeaſon than ought to be uſed in the ſpring or ſummer, unmanageable waters he believes always hurtful.

"It may be proper juſt to add (continues he), that as ſoon as the hay is carried off the meadows, cattle of any ſort except ſheep may be put to eat the graſs out of the trenches, and what may be left by the mowers. This perhaps will laſt them a week; when the water may be put into the meadows in the manner already deſcribed, taking care to mow the long graſs which obſtructs the water in the trenches; and this mowing is beſt done when the water is in them. Let the weeds, leaves, &c. be taken out and put in heaps, to be carried away into the farm-yards; examine the trenches make up the breaches, &c. take particular care that the water only dribbles over every part of the panes as thin as poſſible, this being the warmeſt ſeaſon of the year. The firſt watering ſhould not be ſuffered to laſt longer than two or three days before it is ſhifted off (and if the ſeaſon be wet, perhaps not ſo long, as warmth ſeems to be the greateſt requiſite after the land is once wet to aſſiſt vegetation) to another part or meadow beat out by the cattle, by this time fit to take it. Do by this meadow exactly the ſame, and ſo by a third and fourth, if as many meadows belong to the occupier. Obſerve at all times, when the water is taken out of a meadow, to draw up the drain-ſluice hatches; as, without doing that, watering is an injury. By the time that three or four parts are thus regularly watered, the firſt will have an after-math, with ſuch rich and beautiful verdure as will be aſtoniſhing: and both quantity and quality will be beyond conception better than if the lands had not been watered.

"Hence we ſee why every perſon ſhould if poſſible have three or four meadows that can be watered; for here, while the cattle are eating the firſt, the ſecond is growing, the third draining, &c. and the fourth under water. In this manner the after-math will in a mild ſeaſon laſt till Chriſtmas. A reaſon was given why the ſpring-graſs ſhould be fed only by ſheep or calves: a reaſon equally cogent may be given, why the after-graſs ought not to be fed by them, becauſe it will infallibly rot them. "No ſheep (ſays our author), except thoſe which are juſt fat, muſt ever be ſuffered even for an hour in water-meadows except in the ſpring of the year; and even then care muſt be taken that every part of the meadows have been well watered, and that they are not longer kept in them than the beginning of May. Although at preſent it is unknown what is the occaſion of the rot, yet certain it is that even half an hour's feeding in unhealthy ground has often proved fatal. After a ſhort time they begin to loſe their fleſh, grow weaker and weaker: the beſt feeding in the kingdom cannot improve them after they once fall away; and when they die, animalcula like plaice are found in the livers. Scarcely any ever recover from a ſlight attack; but when farther advanced, it is always fatal. Guard by all means againſt keeping the water too long upon the meadow in warm weather; it will very ſoon produce a white ſubſtance like cream, which is prejudicial to the graſs, and ſhows that it has been too long upon the ground already. If it be permitted to remain a little longer, a thick ſcum will ſettle upon the graſs of the conſiſtence of glue, and as tough as leather, which will quite deſtroy it wherever it is ſuffered to be produced. The ſame bad effects ſeem to ariſe from rude waters; neither can the ſcum eaſily be got off.

32
Water ought not be kept too long upon meadows,

33
Advantage of rolling meadows.

"Rolling meadows in the ſpring of the year in an excellent method. It ſhould be done after Candlemas, when the meadow has been laid dry a week. It ſhould be always rolled lengthwiſe of the panes up one ſide of the trench and down the other. Rolling alſo contributes much to the graſs being cut cloſe to the ſurface when mown, which is no ſmall advantage; for the little hillocks, ſpewings of worms, ant-hills, &c. are by this means preſſed cloſe to the ground, which would otherwiſe obſtruct the ſcythe and take off its edge; and to avoid that inconvenience, the workmen always mow over them."

MEAL, the flour of grain. The meal or flour of Britain is very fine and white. The French is uſually browner, and the German browner than that. Britiſh flour keeps, at home but in carrying abroad it often contracts damp, and becomes bad. All flour is ſubject to breed worms; theſe are white in the white flower, and brown in that which is brown: they are therefore not always diſtinguiſhable to the eye; but when the flour feels damp, and ſmells rank and muſty, it may be conjectured that they are there in great abundance.

The colour and the weight are the two things which denote the value of meal or flour; the whiter and the heavier it is, other things being alike, the better it always is. Pliny mentions theſe two characters as the marks of good flour; and tells us, that Italy in his time produced the fineſt in the world. This country indeed was famous before his time for this produce; and the Greeks have celebrated it; and Sophocles in particular ſays, that no flour is ſo white or ſo good as that of Italy. The corn of this country has, however, loſt much of its reputation ſince that time; and the reaſon of this ſeems to be, that the whole country being full of ſulphur, alum, vitriol, marcaſites, and bitumens, the air may have in time affected them ſo far as to make them diffuſe themſelves through the earth, and render it leſs fit for vegetation; and the taking fire of ſome of theſe inflammable minerals, as has ſometimes happened, is alone ſufficient to alter the nature of all the land about the places where they are.

The flour of Britain, though it pleaſes by its whiteneſs, yet wants ſome of the other qualities valuable in flour; the bread that is made of it is brittle and does not hold together, but after keeping a few days becomes hard and dry as if made of chalk, and is full of cracks in all parts.

The flour of Picardy is very like that of Britain; and after it has been kept ſome time, is found improper for making into paſte or dough. The French are forced either to uſe it immediately on the grinding, or elſe to mix it with an equal quantity of the flour of Brittany, which is coarſer but more unctuous and fatty; but neither of theſe kinds of flour keep well.

The flour of almoſt any country will do for the home conſumption of the place, as it may be always freſh ground; but the great care to be uſed in ſelecting it is in order to the ſending abroad, or furniſhing ſhips for their own uſe. The ſaline humidity of the ſea-air ruſts metals, and fouls every thing on board, if great care be not taken in the preſerving them. This alſo makes the flour damp and mouldy, and is often the occaſion of its breeding inſects, and being wholly ſpoiled.

The flour of ſome places is conſtantly found to keep better at ſea than that of others; and when that is once found out, the whole caution needs only be to carry the flour of thoſe places. Thus the French find that the flour of Poitou, Normandy, and Guienne, all bear the ſea-carriage extremely well; and they make a conſiderable advantage by carrying them to their American colonies. But the flour of Pennſylvania and the neighbouring States is eſteemed the beſt in the world, and the moſt part of the Weſt India Iſlands are ſupplied from thence, and large quantities of wheat and flour are ſent to Europe.

The choice of flour for exportation being thus made, the next care is to preſerve it in the ſhips; the keeping it dry is the grand conſideration in regard to this; the barrels in which it is put up ought to be made of dry and well-ſeaſoned oak, and not to be larger than to hold two hundred weight at the moſt. If the wood of the barrels have any ſap remaining in it, it will moiſten and ſpoil the flour; and no wood is ſo proper as oak for this purpoſe, or for making the bins and other veſſels for keeping flour in at home, ſince when once well dried and ſeaſoned it will not contract humidity afterwards. The beech-wood, of which ſome make their bins for flour, is never thoroughly dry, but always retains ſome ſap. The fir will give the flour a taſte of turpentine; and the aſh is always ſubject to be eaten by worms. The oak is preferable, becauſe of its being free from theſe faults; and when the ſeveral kinds of wood have been examined in a proper manner there may be others found as fit, or poſſibly more ſo, than this for the purpoſe. The great teſt is their having more or leſs ſap. See Flour and Wood.

MEAN, in general, denotes the middle between two extremes; thus we ſay the mean diſtance, mean proportion, &c.

MEARNS, or Kincardinshire, a county of Scotland, bounded on the north by Aberdeenſhire, on the eaſt by the Britiſh Ocean, and on the ſouth-weſt by Anguſhire. In form it reſembles a harp, having the lower point towards the ſouth. Its length along the coaſt is ſcarce 30 miles; its greateſt breadth about 20. Some derive the firſt name from Mearns a valiant nobleman, who ſubduing the country, received it in reward from his prince Kenneth II. Camden, with much probability, ſuppoſes it to retain part of the name of the old inhabitants, the Vernicones of Ptolemy, it being common for the Britons in diſcourſe to change the V into M. The other name is taken from its ancient capital *Kincardine*, now an inconſiderable village. The tract of country through which the Dee paſſes, and the plain along the ſea-coaſt are well cultivated, and produce much corn and flax. The fields are in many places ſkreened by woods; and the heaths afford ſheep-walks and much good paſture for cattle. Near Stonehaven, to the ſouth, are the ruins of Dunotter caſtle, the ancient ſeat of the earls Mariſhal of Scotland, ſituated on a high perpendicular rock, almoſt ſurrounded by the ſea. In this neighbourhood is a precipitous cliff over-hanging the ſea, called *Fowl's Cleugh*: noted as the reſort of kittiwakes, the young of which are much ſought after in the hatching ſeaſon, being eſteemed a great delicacy.—At a little diſtance from Stonehaven, up the river, ſtands Urie, the birth-place of Barclay the famous apologiſt for the Quakers. The Quakers have here a burying ground and in the vicinity are ſeen the traces of a Roman ſtation. The great valley called *Strathmore* commences here, and extends in a ſouth-weſt direction nearly as far as Benlomond in Stirlingſhire, bounded all along to the north-weſt by the Grampian mountains.—The village of Fordun, a little ſouth from the centre of the county, is ſuppoſed to be the birth-place of the celebrated author of the Scotichronicon. St Pady's church, or Paldy kirk in this neighbourhood, is famous for being the burial-place and reſidence of St Palladius; whoſe chapel is ſtill to be ſeen on the ſouth ſide of it, 40 feet by 18, now the burial-place of the Halkerton-family. Near the village, and along the river Bervie, the country is flat and well cultivated. The ſmall town of Inverbervie was made a royal borough by David Bruce, who landed there with his queen at Craig David after his long retreat into France. Near the village of *Fettercairn* was Den Finnel, the reſidence of Finella, daughter of a nobleman of large poſſeſſions in this country, or, as Major calls her, *countes of Angus*, who was acceſſary to the murder of Kenneth II. About two miles from this place, on the road-ſide, is a cairn of a ſtupendous ſize and uncommon form, which probably might give name to the pariſh. About ſix miles weſt from Bervie, is ſituated *Laurencekirk*, which ſome years back was only an inſignificant village of ſix or ſeven houſes; but by the judicious and liberal exertions of its proprietor Lord Gardenſtone, has

has become a handſome little town, with a right to elect magiſtrates, and to hold an annual fair and a weekly market. He has eſtabliſhed here a flouriſhing and extenſive manufacture of lawn, cambric, linen, and various other articles. He has alſo freely renounced all the oppreſſive ſervice due by his tenants; ſervices which have been ſo long and ſo juſtly complained of as a check to agriculture in many parts of Scotland. —The north-weſt part of the ſhire, being mountainous, is more employed in paſture than in cultivation.

MEASLES, a cutaneous diſeaſe attended with a fever, in which there is an appearance of eruptions that do not tend to a ſuppuration. See (the *Index* ſubjoined to) Medicine.

MEASURE in geometry, denotes any quantity aſſumed as one, or unity, to which the ratio of the other homogeneous or ſimilar quantities is expreſſed.

Measure, in a legal and commercial ſenſe, denotes a certain quantity or proportion of any thing, bought ſold, valued, or the like.

It is neceſſary, for the convenience of commerce that an uniformity ſhould be obſerved in weights and meaſures, and regulated by proper ſtandards. A foot-rule may be uſed as a ſtandard for meaſures of length, a buſhel for meaſures of capacity, and a pound for weights. There ſhould be only one authentic ſtandard of each kind, formed of the moſt durable materials, and kept with all poſſible care. A ſufficient number of copies, exactly correſponding to the principal ſtandard, may be diſtributed for adjuſting the weights and meaſures that are made for common uſe. There are ſeveral ſtandards of this kind both in England and Scotland. See the article *Weights and Meaſures*.

If any one of the ſtandards abovementioned be juſtly preſerved, it will ſerve as a foundation for the others by which they may be corrected if inaccurate. or reſtored if entirely loſt. For inſtance, if we have a ſtandard foot, we can eaſily obtain an inch, and can make a box which ſhall contain a cubical inch, and may ſerve as a ſtandard for meaſures of capacity. If it be known that a pint contains 100 cubical inches we may make a veſſel five inches ſquare, and four inches deep which will contain a pint. If the ſtandard be required in any other form, we may fill this veſſel with water, and regulate another to contain an equal quantity. Standards for weights may be obtained from the ſame foundation; for if we know how many inches of water it takes to weigh a pound, we have only to meaſure that quantity, and the weight which balances it may be aſſumed as the ſtandard of a pound.

Again, if the ſtandard of a pound be given, the meaſure of an inch may be obtained from it: for we may weigh a cubical inch of water, and pour it into a regular veſſel: and having noticed how far it is filled, we may make another veſſel of like capacity in the form of a cube. The ſide of this veſſel may be aſſumed as the ſtandard for an inch: and ſtandards for a foot, a pint, or a buſhel, may be obtained from it. Water is the moſt proper ſubſtance for regulating ſtandards; for all other bodies differ in weight from others of the ſame kind: whereas it is found by experience that ſpring and river water, rain, and melted ſnow and all other kinds, have the ſame weight: and this uniformly holds in all countries when the water is pure, alike warm, and free from ſalt and minerals.

Thus, any one ſtandard is ſufficient for reſtoring all the reſt. It may further be deſired to hit on ſome expedient, if poſſible, for reſtoring the ſtandards, in caſe that all of them ſhould ever fall into diſorder, or ſhould be forgotten, through the length of time, and the viſciſſitudes of human affairs. This ſeems difficult, as no words can convey a preciſe idea of a foot-rule, or a pound weight. Meaſures, aſſumed from the dimenſions of the human body, as a foot, a hand-breadth, or a pace, muſt nearly be the ſame in all ages, unleſs the ſize of the human race undergo ſome change; and therefore, if we know how many ſquare feet a Roman acre contained, we may form ſome judgment of the nature of the law which reſtricted the property of a Roman citizen to ſeven acres: and this is ſufficient to render hiſtory intelligible; but it is too inaccurate to regulate meaſures for commercial purpoſes. The ſame may be ſaid of ſtandards, deduced from the meaſure of a barley-corn, or the weight of a grain of wheat. If the diſtance of two mountains be accurately meaſured and recorded, the nature of the meaſure uſed will be preſerved in a more permanent manner than by any ſtandard; for if ever that meaſure fall into diſuſe and another be ſubſtituted in its place, the diſtance may be meaſured again, and the proportion of the ſtandards may be aſcertained by comparing the new and ancient diſtances.

But the moſt accurate and unchangeable manner of eſtabliſhing ſtandards is, by comparing them with the length of pendulums. The longer a pendulum is, it vibrates the ſlower: and it muſt have one preciſe length in order to vibrate in a ſecond. The ſlighteſt difference in length will occaſion a difference in the time; which will become abundantly ſenſible after a number of vibrations, and will be eaſily obſerved if the pendulum be applied to regulate the motion of a clock. The length of a pendulum which vibrates ſeconds in London is about $39\frac{1}{8}$ inches, is conſtantly the ſame at the ſame place; but it varies a little with the latitude of the place, being ſhorter as the latitude is leſs. Therefore though all ſtandards of weights and meaſures were loſt, the length of a ſecond pendulum might, be found by repeated trials; and if the pendulum be properly divided, the juſt meaſure of an inch will be obtained; and from this all other ſtandards may he reſtored. See *Whitehurſt on Invariable Measures*.

Meaſures are various, according to the various kinds and dimenſions of the things meaſured.—Hence ariſe lineal or longitudinal meaſures, for lines or lengths; ſquare meaſures, for areas or ſuperfices; and ſolid or cubic meaſures, for bodies, and their capacities; all which again are very different in different countries and in different ages, and even many of them for different commodities. Whence ariſe other diviſions of ancient and modern meaſures, domeſtic, and foreign ones, dry meaſures, liquid meaſures, &c.

1.] *Long Meaſures or Meaſures af Application.*

1.] The *Engliſh* and *Scotch* Standards.

The Engliſh lineal ſtandard in the yard, containing 3 Engliſh feet; equal to 3 Paris feet 1 inch and $\frac{3}{11}$

of an inch, or $\frac{7}{9}$ of a Paris ell. The uſe of this meaſure was eſtabliſhed by Henry I. of England, and the ſtandard taken from the length of his own arm. It is divided into 36 inches, and each inch is ſuppoſed equal to 3 barley-corns. When uſed for meaſuring cloth, it is divided into four quarters, and each quarter ſubdivided into 4 nails. The Engliſh ell is equal to a yard and a quarter, or 45 inches, and is uſed in meaſuring linens imported from Germany and the Low-Countries.

The Scots *elwand* was eſtabliſhed by king David I. and divided in 37 inches. The ſtandard is kept in the council-chamber of Edinburgh, and being compared with the Engliſh yard, is found to meaſure 37$\frac{1}{5}$ inches; and therefore the Scots inch and foot are larger than the Engliſh, in the proportion of 180 to 185; but this difference being ſo inconſiderable, is ſeldom attended to in practice. The Scots ell, though forbidden by law, is ſtill uſed for meaſuring ſome coarſe commodities, and is the foundation of the land-meaſure of Scotland.

Itinerary meaſure is the ſame both in England and Scotland. The length of the chain is 4 poles, or 22 yards; 83 chains make a mile. The old Scots computed miles were generally about a mile and a half each.

The reel for yarn is 2$\frac{1}{2}$ yards, or 10 quarters, in circuit; 120 threads make a cut, 12 cuts make a haſp or hank, and 4 hanks make a ſpindle.

2.] The *French* Standard is the aune or ell, containing 3 Paris feet 7 inches 8 lines, or 1 yard $\frac{2}{7}$ Engliſh; the Paris foot royal exceeding the Engliſh by $\frac{68}{1000}$ parts, as in one of the following tables. This ell is divided two ways, viz. into halves, thirds, ſixths and twelfths; and into quarters, half-quarters, and ſixteenths.

This ell holds throughout the greateſt part of France; excepting at Troyes in Champagne, at Arc in the Barrois, and in ſome parts of Picardy and Burgundy, where the ell contains only 2 feet 5 inches 1 line; in Bretagne, where it contains 4 feet 2 inches 11 lines; and at St Genoux in Berry, where it exceeds the Paris ell by 8 lines. See Ell. But in Languedoc, particularly at Marſeilles Montpelier, Thouloufe in Provence, and in Guienne, they meaſure by the canna, which at Thoulouſe and in Guienne contains 5 Paris feet 5 inches and 6 lines; or one Paris ell and a half. But at Montpelier, and throughout the Lower Languedoc, as alſo in Provence and Avignon, and even Dauphine, the canna is 6 feet and 6 lines, or 1 Paris ell and $\frac{2}{3}$. See Canna.

We have lately had ſome accurate compariſons between ſome of the French weights and meaſures and thoſe of England, the reſult of which is, (1.) The Paris half toiſe, as ſet off on the ſtandard kept in the Royal Society: contains of Engliſh icnhes by the ſame ſtandard 38.355, whence it appears, that the Engliſh yard and foot is, to the Paris half toiſe and foot, nearly as 107 to 114; for as 107 to 114, ſo is 39 to 38.35514.

(2.) The Paris 2 marc, or 16 ounce weight, weighs Engliſh Troy grains 7560; whence it appears, that the Engliſh Troy pound of 12 ounces, or 5760 grains, is to the Paris 1 mare, or 19 ounce weight, as 16 to 21; that the Paris ounce weighs Engliſh Troy grains 472.5 and that conſequently, the Engliſh Troy ounce is to the Paris ounce as 64 is to 63.

(3). The Engliſh Avoirdupois pound weighs Troy grains 7004; whence the Avoirdupois ounce, whereof 16 make a pound, is found equal to 437.75 Troy grains.—And it follows, that the Troy pound is to the Avoirdupois pound as 88 to 107 nearly; for as 88 to 107, ſo is 5760 to 7003.636; that the Troy ounce is to the Avoirdupois ounce, as 80 to 73 nearly; for as 80 to 73, ſo is 480 to 438. And, laſtly, that the Avoirdupois pound and ounce, is to the Paris two marc weight and ounce, as 63 to 68 nearly: for as 63 to 68, ſo is 7004 to 7559.873. See Weight.

(4.) The Paris foot expreſſed in decimals, is equal to 1.0654 of the Engliſh foot, or contains 12.785 Engliſh inches. See Foot.

3.] The ſtandard in *Holland*, *Flanders*, *Sweden*, a good part of *Germany*, many of the Hans-towns, as *Dantzick*, and *Hamburgh*, and at *Geneva*, *Fanckfort*, &c. is likewiſe the ell; but the ell, in all theſe places, differs from the Paris ell. In Holland, it contains one Paris foot eleven lines, or four ſevenths of the Paris ell. The Flanders ell contains two feet one inch five lines and half a line; or ſeven twelfths of the Paris ell. The ell of Germany, Brabant, &c. is equal to that of Flanders.

4.] *The Italian* meaſure is the bracchio, brace, or fathom. This obtains in the ſtates of Modena, Venice, Florence, Lucca, Milan, Mantua, Bologna, &c. but is of different lengths. At Venice, it contains one Paris foot eleven inches three lines, or eight fifeenths of the Paris ell. At Bologna, Modena, and Mantua, the brace is the ſame as at Venice. At Lucca it contains one Paris foot nine inches ten lines, or half a Paris ell. At Florence, it contains one foot nine inches four lines, or forty-nine hundredths of a Paris ell. At Milan, the brace for meaſuring of ſilks is one Paris foot ſeven inches four lines, or four-ninths of a Paris ell; that for woollen cloths is the ſame with the ell of Holland. Laſtly, at Bergama, the brace is one foot ſeven inches ſix lines, or five-ninths of a Paris ell. The uſual meaſure at Naples, however, is the canna, containing ſix feet ten inches and two lines, or one Paris ell and fifteen ſeventeenths.

5.] *The Spaniſh* meaſure is the vara or yard, in ſome places called the barra; containing ſeventeen twenty-fourths of the Paris ell. But the meaſure in Baſtile and Valencia is the pan, ſpan, or palm; which is uſed, together with the canna, at Genoa. In Arragon, the vara is equal to a Paris ell and a half, or five feet five inches ſix lines.

6.] *The Portugueſe* meaſure is the cavedos, containing two feet, eleven lines, or four-ſevenths of a Paris ell; and the varra, a hundred and ſix whereof make a hundred Paris ells.

7.] *The Piedmonteſe* meaſure is the ras, containing one Paris foot nine inches ten lines, or half a Paris ell. In Sicily, their meaſure is the canna, the ſame with that of Naples.

8.] *The Muſcovite* meaſures are the cubit, equal to one Paris foot four inches two lines: and the arcin, two whereof are equal to three cubits.

9.] *The Turkiſh* and *Levant* meaſures are the picq, containing two feet two inches and two lines, or three fifths of the Paris ell. The Chineſe meaſure, the cobre; ten whereof are equal to three Paris ells. In Perſia, and ſome parts of the Indies, the gueze, whereof there are two kinds; the royal gueze, called alſo the *gueze monkelſer*, containing two Paris feet ten inches eleven lines, or four-fifths of the Paris ell; and the ſhorter gueze, called ſimply *gueze*, only two thirds of the former. At Goa and Ormuz, the meaſure is the vara, the ſame with that of the Portugueſe, having been introduced by them. In Pegu, and ſome other parts of the Indies, the cando or candi, equal to the ell of Venice. At Goa, and other parts, they uſe a larger cando, equal to ſeventeen Dutch ells; exceeding that of Babel and Balſora by $\frac{7}{8}$ *per centum*, and the vara by $6\frac{1}{4}$. In Siam, they uſe the ken, ſhort of three Paris feet by one inch. The ken contains two ſoks, the ſok two keubs, the keub twelve nious or inches, the niou to be equal to eight grains of rice, i. e. to about nine lines. At Camboia, they uſe the haſter; in Japan, the tatam; and the ſpan on ſome of the coaſts of Guinea.

TABLES of LONG Meaſure.

1. ENGLISH.

Barley-corn											
3	Inch										
9	3	Palm									
27	9	3	Span								
36	12	4	$1\frac{1}{3}$	Foot							
54	18	6	2	$1\frac{1}{2}$	Cubit						
108	36	12	4	3	2	Yard					
180	60	20	$6\frac{2}{3}$	5	$3\frac{1}{3}$	$1\frac{2}{3}$	Pace				
216	72	24	8	6	4	2	$1\frac{1}{5}$	Fathom			
594	198	66	22	$16\frac{1}{2}$	11	$5\frac{1}{2}$	$3\frac{3}{10}$	$2\frac{3}{4}$	Pole		
23760	7920	2640	880	660	440	220	132	110	40	Furlong	
190080	63360	21120	7040	5280	3520	1760	1056	880	320	8	Mile.

2. *SCRIPTURE Meaſures reduced into Engliſh.*

								Eng. feet.	Inch Dec
Digit								0	0.912
4	Palm							0	3.648
12	3	Span						0	10.944
24	6	2	Cubit					1	9.888
96	24	8	4	Fathom				7	3.552
144	36	12	6	$1\frac{1}{2}$	Ezekiel's reed			10	11.328
192	48	16	8	2	$1\frac{1}{3}$	Arabian pole		14	7.104
1920	480	160	80	20	$13\frac{1}{3}$	10	Schœnus or meaſuring line	145	11.04

3. *The SCRIPTURE Itinerary Meaſures.*

						Eng. Miles.	Paces.	Feet.
Cubit						0	0	1.824
400	Stadium					0	145	4.6
2000	5	Sab. day's journey.				0	729	3.000
4000	10	2	Eaſtern mile			1	403	1.000
1 0 00	30	6	3	Paraſan		4	153	3.000
96000	240	48	24	8	a day's journey	33	172	4.000

4. GRECIAN.

												Paces.	Feet.	Dec.
Dactylus, digit												0	0	$0.7554\frac{1}{16}$
4	Doron, dochme											0	0	$3.0218\frac{3}{4}$
10	$2\frac{1}{2}$	Lichas										0	0	$7.5546\frac{7}{8}$
11	$2\frac{3}{4}$	$1\frac{1}{10}$	Orthodoron									0	0	$8.3101\frac{9}{10}$
12	3	$1\frac{1}{5}$	$1\frac{1}{11}$	Spithame								0	0	$9.0656\frac{1}{4}$
16	4	$1\frac{6}{10}$	$1\frac{5}{11}$	$1\frac{1}{3}$	Foot							0	1	0.0875
18	$4\frac{1}{2}$	$1\frac{4}{5}$	$1\frac{7}{11}$	$1\frac{1}{2}$	$1\frac{1}{8}$	Cubit						0	1	$1.5984\frac{3}{8}$
20	5	2	$1\frac{9}{11}$	$1\frac{2}{3}$	$1\frac{1}{4}$	$1\frac{1}{9}$	Pygon					0	1	$3.109\frac{3}{8}$
24	6	$2\frac{2}{5}$	$2\frac{2}{11}$	2	$1\frac{1}{2}$	$1\frac{1}{3}$	$1\frac{1}{5}$	Cubit larger				0	1	6.13125
96	24	$9\frac{3}{5}$	$8\frac{8}{11}$	8	6	$5\frac{1}{3}$	$4\frac{4}{5}$	4	Pace.			0	6	0525
9600	2400	960	$872\frac{8}{11}$	800	600	$533\frac{1}{3}$	480	400	100	Furlong		100	4	4.5
76800	19200	7680	$6981\frac{9}{11}$	6400	6800	$4266\frac{2}{3}$	3840	3200	800	8	Mile.	805	5	0

5. ROMAN.

										Paces.	Feet.	Dec.
Digitus tranſverſus										0	0	$0.725\frac{1}{4}$
$1\frac{1}{3}$	Uncia									0	0	0.967
4	3	Palmus minor								0	0	2.901
16	12	4	Pes							0	0	11.604
20	15	5	$1\frac{1}{4}$	Palmipes						0	1	2.505
24	18	6	$1\frac{1}{2}$	$1\frac{1}{5}$	Cubitus					0	1	5.406
40	30	10	$2\frac{1}{2}$	2	$1\frac{2}{3}$	Gradus				0	2	5.01
80	60	20	5	4	$3\frac{1}{3}$	2	Paſſus			0	4	10.02
10000	7500	2500	625	500	$416\frac{2}{3}$	250	125	Stadium		120	4	4.5
80000	60000	20000	5000	4000	$3333\frac{1}{3}$	2000	1000	8	Milliare.	967	0	0

6. *Proportions of ſeveral Long Meaſures to each other, by Mr Picard.*

The Rhinland or Leyden foot (12 whereof make the Rhinland perch) ſuppoſed	696
The Engliſh foot	$675\frac{1}{2}$
The Paris foot	720
The Amſterdam foot, from that of Leyden, by Snellius	629
The Daniſh foot (two whereof make the Daniſh ell)	$701\frac{8}{10}$
The Swediſh foot	$658\frac{1}{4}$
The Bruſſels foot	$609\frac{3}{5}$
The Dantzic foot, from Hevelius's Selenographia	636
The Lyons foot, by M. Auzout	$757\frac{2}{3}$
The Bologna foot, by the ſame	843
The braccio of Florence, by the ſame, and Father Merſenne	1290
The palm of the architects at Rome, according to the obſervations of Meſſrs Picard and Auzout	$494\frac{1}{4}$
The Roman foot in the Capitol, examined by Meſſrs Picard and Auzout	653 or $653\frac{1}{2}$
The ſame from the Greek foot	652
From the vineyard Mattei	$657\frac{1}{2}$
From the palm	$658\frac{3}{4}$
From the pavement of the pantheon, ſuppoſed to contain ten Roman feet	653
From a ſlip of marble in the ſame pavement, ſuppoſed to contain three Roman feet	650
From the pyramid of Ceſtius, ſuppoſed to contain 95 Roman feet	$653\frac{1}{2}$

From

From the diameters of the columns in the arch of Septimius Severus - - $653\frac{1}{3}$

From a ſlip of porphyry in the pavement of the pantheon - - $653\frac{1}{3}$

See on this ſubject Phil. Tranſ. Vol. LI. art. 69. p. 774.

7. *Proportions of the Long Meaſures of ſeveral nations to the Engliſh foot, taken from Mr Greaves, Auzout, Picard, and Eiſenchmid.* See Foot.

The Engliſh ſtandard foot being divided into 1000 equal parts, the other meaſures will have the proportions to it, which follow:

	Feet.	Inches.
Engliſh foot - -	1000	12
Paris foot - -	1068	12,816
Venetian foot - -	1162	13,944
Rhinland foot - -	1033	12,396
Straſburgh foot -	952	11.424
Norimberg foot - -	1000	12
Dantzick foot - -	944	11,328
Daniſh foot - -	1042	12,504
Swediſh foot - -	$977\frac{3}{4}$	11,733
Derahor cubit of Cairo, -	1824	21,888
Perſian ariſh - -	3197	38,364
Greater Turkiſh pike -	2200	26,4
Leſſer Turkiſh pike - -	2131	25,572
Braccio at Florence -	1913	22,956
Braccio for woollen at Siena	1242	14,904
Braccio for linen at Siena -	1974	23,688
Canna at Naples - -	6880	82,56
Vera at Almaria and Gibraltar	2760	33,12
Palmo di Architetti at Rome	732	87,84
Canna di Architetti - -	7320	87,84
Palmo di braccio di mercantia	$695\frac{1}{2}$	8,346
Genoa Palm - -	815	9,78
Bolognian foot - -	1250	15
Antwerp ell - -	2283	27,396
Amſterdam ell -	2268	27,216
Leyden ell - -	2260	27,12
Paris draper's ell -	3929	47,148
Paris mercer's ell -	3937	47,244

8. *Different Itinerary Meaſures.*

A French league is about	$2\frac{3}{4}$	Engliſh miles.
A German mile	4	ditto.
A Dutch mile	$3\frac{1}{4}$	ditto.
An Italian mile	$\frac{1}{7}\frac{1}{2}$	ditto.
A Spaniſh league	$3\frac{2}{3}$	ditto.
A Ruſſian verſt	$\frac{3}{4}$	ditto.

II. *Square, Superficial, or Land Meaſure.*

1.] *Engliſh* ſquare meaſures are raiſed from the yard of 36 inches multiplied into itſelf, and thus producing 1296 ſquare inches in the ſquare yard; the diviſions of this are ſquare feet and inches; and the multiples, poles, roods, and acres. Becauſe the length of a pole is $5\frac{1}{2}$ yards, the ſquare of the ſame contains $30\frac{1}{4}$ ſquare yards. A ſquare mile contains 640 ſquare acres. In meaſuring fens and woodlands, 18 feet are generally allowed to the pole, and 21 feet in foreſt lands.

A hide of land, frequently mentioned in the earlier part of the Engliſh hiſtory, contained about 100 arable acres; and 5 hides were eſteemed a knight's fee. At the time of the Norman conqueſt, there were 243,600 hides in England.

2.] *Scotch* ſquare or land meaſure is regulated by the Scotch ell: 36 ſquare ells = 1 fall, 40 falls = 1 rood, 4 roods = 1 acre.—The proportion between the Scotch and Engliſh acre, ſuppoſing the feet in both meaſures alike, is as 1369 to 1089, or nearly as 5 to 4. If the difference of the feet be regarded, the proportion is as 10,000 to 7869. The length of the chain for meaſuring land in Scotland is 24 ells, or 74 feet.—A huſband-land contains 6 acres of ſock and ſcythe land, that is, of land that may be tilled with a plough or mown with a ſcythe: 13 acres of arable land make one ox-gang, and 4 ox-gangs make a pound-land of old extent.

3.] *French* ſquare meaſures are regulated by 12 ſquare lines in the inch ſquare; 12 inches in the foot, 22 feet in the perch, and 100 perches in the arpent or acre.

Tables of Square Meaſure.

1. English.

Inches						
144	Feet					
1296	9	Yards				
3600	25	$2\frac{7}{9}$	Paces			
39204	$272\frac{1}{4}$	$30\frac{1}{4}$	10.89	Poles		
1568160	10890	1210	435.6	40	Rood	
6272640	43560	4840	1743.6	160	4	Acre

2. *Grecian* ſquare meaſures were the plethron or acre, by ſome ſaid to contain 1444, by others 10,000 ſquare feet; and aroura the half of the plethron. The aroura of the Egyptians was the ſquare 100 cubits.

3. *Roman* ſquare meaſure reduced to Engliſh. The integer was the jugerum or acre, which the Romans divided like the libra or as: thus the jugerum contained.

	ſquare feet.	ſcruples.	Engliſh roods.	ſq. poles.	Square feet.
As	28800	288	2	18	250.05
Deunx	26400	264	2	10	183.85
Dextans	24000	240	2	2	117.64
Dodrans	21600	216	1	34	51.42
Bes	19200	192	1	25	257.46
Septunx	16800	168	1	17	191.25
Semis	14400	144	1	9	125.03
Quincunx	12000	120	1	1	58.82
Triens	9600	96	0	32	264.85
Quadrans	7200	72	0	24	198.64
Sextans.	4800	48	0	16	132.43
Uncia	2400	24	0	8	66.21

Note; Actus major was 14,400 ſquare feet equal to a ſemis: clima, 3600 ſquare feet, equal to a ſeſcuncia; and actus minimus equal to a ſextans.

III. *CUBICAL Meaſures*, or Meaſures of Capacity, for LIQUIDS.

1.] The *Engliſh* meaſures were originally raiſed from troy-weight: it being enacted by ſeveral ſtatutes, that eight pounds troy of wheat, gathered from the middle of the ear, and well dried, ſhould weigh a gallon of wine meaſure, the diviſions and multiples whereof were to form the other meaſures; at the ſame time it was alſo ordered, that there ſhould be but one liquid meaſure in the kingdom: yet cuſtom has prevailed, and there having been introduced a new weight, viz. the avoirdupois, we have now a ſecond ſtandard gallon adjuſted thereto, and therefore exceeding the former in the proportion of the avoirdupois weight to troy weight. From this latter ſtandard are raiſed two ſeveral meaſures, the one for ale, the other for beer. The ſealed gallon at Guildhall, which is the ſtandard for wines, ſpirits, oils, &c. is ſuppoſed to contain 231 cubic inches; and on this ſuppoſition the other meaſures raiſed therefrom, will contain as in the table underneath: yet by an actual experiment, made in 1688, before the lord-mayor and the commiſſioners of exciſe, this gallon was found to contain only 224 cubic inches: it was however agreed to continue the common ſuppoſed contents of 231 cubic inches; ſo that all computations ſtand on their old footing. Hence, as 12 is to 231, ſo is $14\frac{12}{27}$ to $281\frac{1}{2}$ the cubic inches in the ale-gallon: but in effect the ale-quart contains $70\frac{1}{2}$ cubic inches, on which principle the ale and beer gallon will be 282 cubic inches. The ſeveral diviſions and multiples of theſe meaſures, and their proportions, are exhibited in the tables underneath.

The barrel for ale in London is 32 gallons, and the barrel for beer 36 gallons. In all others places of England, the barrel, both for ale and beer, is 34 gallons.

2.] *Scotch* liquid meaſure is founded on the pint. The Scotch pint was formerly regulated by a ſtandard jug of caſt metal, the cuſtody of which was committed to the borough of Stirling. This jug was ſuppoſed to contain 105 cubic inches; and though, after ſeveral careful trials, it has been found to contain only about $103\frac{1}{2}$ inches; yet, in compliance with eſtabliſhed cuſtom, founded on that opinion, the pint *ſtoups* are ſtill regulated to contain 105 inches, and the cuſtomary ale meaſures are about $\frac{1}{16}$ above that ſtandard. It was enacted by James I. of Scotland, that the pint ſhould contain 41 ounces Trone weight of the clear water of Tay, and by James VI. that it ſhould contain 55 Scots Troy ounces of the clear water of Leith. This affords another method of regulating the pint, and alſo aſcertains the ancient ſtandard of the Trone weight. As the water of Tay and Leith are alike, the Trone weight muſt have been to the Scots Troy weight as 55 to 41; and therefore, the pound Trone muſt have contained about $21\frac{1}{2}$ ounces Scots Troy.

4 gills = 1 mutchkin.
2 mutchkins = 1 chopin.
2 chopins = 1 pint.
2 pints = 1 quart.
4 quarts = 1 gallon.

The Scotch quart contains 210 inches; and is, therefore, about $\frac{1}{16}$ leſs than the Engliſh wine gallon, and about $\frac{1}{4}$ leſs than the ale-gallon.

3.] As to the liquid meaſures of foreign nations, it is to be obſerved, that their ſeveral veſſels for wine, vinegar, &c. have alſo various denominations according to their different ſizes and the places wherein they are uſed. The woeders of Germany, for holding Rheniſh and Moſelle wines, are different in their gauges; ſome containing 14 aumes of Amſterdam-meaſure, and others more or leſs. The aume is reckoned at Amſterdam for 8 ſteckans, or 20 verges, or for $\frac{1}{6}$ of a ton of 2 pipes; or 4 barrels of French or Bourdeaux, which $\frac{1}{6}$ at this latter place is called *tiercon*, becauſe 3 of them make a pipe or 2 barrels, and 6 the ſaid ton. The ſteckan is 16 mingles, or 32 pints; and the verge is, in reſpect of the ſaid Rheniſh and Moſelle, and ſome other ſorts of wine, 6 mingles; but, in the meaſuring brandy, it conſiſts of $6\frac{1}{6}$ mingles. The aume is divided into 4 anckers, and the ancker into 2 ſteckans, or 32 mingles. The ancker is taken ſometimes for $\frac{1}{24}$ of a ton, or 4 barrels; on which footing the Bourdeaux-barrel ought to contain at Amſterdam (when the caſk is made according to the juſt gauge) $12\frac{1}{2}$ ſteckans, or 200 mingles wine and lees; or 12 ſteckans, or 192 mingles racked wine; ſo that the Bourdeaux-ton of wine contains 50 ſteckans, or 800 mingles, wine and lees; and 48 ſteckans, or 768 mingles of pure wine. The barrels or poinçons of Nantes and other places on the river Loire, contain only 12 ſteckans Amſterdam meaſure. The wine-ton of Rochelle, Cognac, Charente, and the Iſle of Rhe, differs very little from the ton of Bourdeaux, and conſequently from the barrels and pipes. A ton of wine of Chaloſſe, Bayonne, and the neighbouring places, is reckoned 60 ſteckans, and the barrel 15, Amſterdam-meaſure.

The muid of Paris contains 150 quarts, or 300 pints, wine and lees; or 280 pints clear wine; of which muids 3 make a ton, and the fractions are

The muid	containing	36 ſetiers
The ſetier		4 quarts
The quart		2 pints
The pint		2 chopins
The chopin		2 demi-ſetiers
The demi-ſetier		2 poiſſons.

The muid is alſo compoſed of pipes, or poinçons, quarteaux, queves, and demiqueves: thoſe poinçons of Paris and Orleans contain about 15 ſteckans Amſterdam meaſure, and ought to weigh with the caſk 666 lb. a little more or leſs. In Provence they reckon by milleroles, and the millerole of Toulon contains 66 Paris pints, or 100 pints of Amſterdam, nearly; and the Paris pint is nearly equal to the Engliſh wine-quart.

The butts or pipes from Cadiz, Malaga, Alicant, Benecarlo, Saloe, and Martaro, and from the Canaries, from Liſbon, Oporto, and Fayal, are very different in their guages, though in affreightments they are all reckoned two to the ton.

Vinegar is meaſured in the ſame manner as wine; but the meaſures for brandies are different: theſe ſpirits from France, Spain, Portugal, &c. are generally ſhipped in large caſks called *pipes*, *butts*, and *pieces*, according to the places from whence they are reported, &c. In France, brandy is ſhipped in caſks called *pieces* at Bourdeaux, and *pipes* at Rochelle, Cognac, the iſle of Rhé, and other neighbouring places,

places, which contain ſome more and ſome leſs, even from 60 to 90 Amſterdam verges or verteels, according to the capacity of the veſſels, and the places they come from, which being reduced into barrels will ſtand as follows, viz.

At Rochelle, Cognac, the Iſle of Rhé, and the country of Aunis	27 Veertels	per barrel.
At Nants, and ſeveral places of Bretagne and Anjou - -	29 Veertels	
At Bourdeaux, and different parts of Guienne - -	32 Verges	
At Amſterdam, and other cities of Holland	30 Veertels	
At Hamburgh and Lubeck	30 Verges	
At Embden - -	27 Verges	

In Provence and Languedoc, brandy is ſold by the quintal, the caſks included; and at Bruges in Flanders, the verges are called *ſeſters* of 16 ſtops each, and the ſpirit is ſold at ſo much per ſtop.

Olive oil is alſo ſhipped in caſks of various ſizes, according to the cuſtom of the places where it is embarked and the conveniency of ſtowage. In England it is ſold by the ton of 236 gallons; and at Amſterdam by the ton of 717 mingles, or 1434 pints. In Provence it is ſold by milleroles of 66 Paris pints; from Spain and Portugal it is brought in pipes or butts, of different gauges; at the firſt place it is ſold by roves, whereof 40 go to the butt; and at the latter place by Almoudas, whereof 26 makes a pine. Train oil is ſold in England by the ton, at Amſterdam by the barrel.

Tables of Liquid Meaſure.

1. English.

[*Wine.*]

Solid inches.									
28 7/8	Pint								
231	8	Gallon							
4158	144	18	Rundlet						
7276 1/2	252	31 1/2	1 3/4	Barre					
9702	336	42	2 1/3	1 1/3	Tierce				
14553	504	63	3 1/2	2	1 1/6	Hogſhead			
19279	672	84	4 2/3	2 2/3	2	1 1/2	Puncheon		
29106	1008	126	7	4	3	2	1 1/2	Butt or pipe	
58212	2016	252	14	8	6	4	3	2	Tun.

[*Ale.*]

Pints				
8	Gallon			
64	8	Firkin		
128	16	2	Kilderkin	
256	32	4	2	Barrel
512	64	8	4	2 Hog.

[*Beer.*]

Pints				
8	Gallon			
72	9	Firkin		
144	18	2	Kilderkin	
288	36	4	2	Barrel
576	72	8	4	2 Hog.

2. Jewish reduced to Engliſh Wine-meaſure.

							Gall.	Pints	Solid inches.
Caph							0	0 5/8	0.177
1 1/3	Log						0	0 5/6	0.211
5 1/3	4	Cab					0	3 1/3	0.844
16	12	3	Hin				1	2	2.533
32	24	6	2	Seah			2	4	5.067
96	72	18	6	3	Bath, or Epha		7	4	15.2
960	720	180	60	30	10	Coron, or Chomer.	75	5	7.265

3. **Attic** reduced to Engliſh Wine-Meaſure.

										Gal.	Pints.	Sol. inch. Dec.
Cochliarion										0	$\frac{1}{120}$	0.0356 $\frac{5}{12}$
2	Cheme									0	$\frac{1}{60}$	0.0712 $\frac{5}{6}$
2½	1¼	Myſtron								0	$\frac{1}{48}$	0.089 $\frac{11}{48}$
5	2½	2	Conche							0	$\frac{1}{24}$	0.178 $\frac{11}{48}$
10	5	4	2	Cyathos						0	$\frac{1}{12}$	0.356 $\frac{11}{12}$
15	7½	6	3	1½	Oxybaphon					0	$\frac{1}{8}$	0.535 $\frac{5}{8}$
60	30	24	12	6	4	Cotyle				0	$\frac{1}{2}$	2.141 $\frac{1}{2}$
120	60	48	24	12	8	2	Xeſtes			0	1	4.283
720	360	288	144	72	48	12	6	Chous		0	6	25.698
3640	4320	3456	1728	864	576	144	72	12	Metretes	10	2	19.629

4. **Roman** reduced to Engliſh Wine-meaſure.

										Gal.	Pints.	Sol. inch. Dec.
Ligula										0	0 $\frac{1}{48}$	0.117 $\frac{3}{13}$
4	Cyathus									0	0 $\frac{1}{12}$	0.469 $\frac{2}{3}$
6	1½	Acetabulum								0	0 $\frac{1}{8}$	0.704 $\frac{1}{2}$
12	3	2	Quartarius							0	0 $\frac{1}{4}$	1.409
24	6	4	2	Hemina						0	0 ^{1}	2.818
48	12	8	4	2	Sextarius					0	1	5.636
288	72	48	24	12	6	Congius				0	7	4.942
1152	288	192	96	48	24	4	Urna			3	4 $\frac{1}{2}$	5.33
2304	576	384	192	96	48	8	2	Amphora		7	1	10.66
46080	11520	7680	3840	1920	960	160	40	20	Culeus	143	3	11.095

IV. *Meaſures of Capacity for things* Dry.

1.] *Engliſh* dry or corn meaſure. The ſtandard for meaſuring corn, ſalt, coals, and other dry goods, in England, is the Wincheſter gallon which contains 272¼ cubic inches. The buſhel contains 8 gallons, or 2178 inches. A cylindrical veſſel, 18½ inches diameter, and 8 inches deep, is appointed to be uſed as a buſhel in levying the malt-tax. A veſſel of theſe dimenſions is rather leſs than the Wincheſter buſhel of 8 gallons, for it contains only 2150 inches; though probably there was no difference intended. The denominations of dry meaſure commonly uſed, are given in the firſt of the ſubjoined tables. Four quarters corn make a chaldron, 5 quarters make a wey or load, and 10 quarters make a ton. In meaſuring ſea-coal, 5 pecks make a buſhel, 9 buſhels make a quarter or vatt, 4 quarters make a chaldron, and 21 chaldrons make a ſcore.

40 feet hewn timber make a load.
50 feet unhewn timber make a load.
32 gallons make a herring barrel.
42 gallons make a ſalmon barrel.
1 cwt. gun-powder makes a barrel.
256 lb. ſoap make a barrel.
10 dozen candles make a barrel.
12 barrels make a laſt.

2.] *Scotch* dry meaſure. There was formerly only one meaſure of capacity in Scotland; and ſome commodities were heaped, others *ſtraiked*, or meaſured exactly to the capacity of the ſtandard. The method of heaping was afterwards forbidden as unequal, and a larger

larger meaſure appointed for ſuch commodities as that cuſtom had been extended to.

The wheat-firlot, uſed alſo for rye, peaſe, beans, ſalt, and graſs-ſeeds, contains 21 pints 1 mutchkin, meaſured by the Stirling jug. The barley firlot, uſed alſo for oats, fruit, and potatoes, contains 31 pints. A different method of regulating the firlot was appointed, from the dimenſions of a cylindrical veſſel. The diameter for both meaſures was fixed at $19\frac{1}{6}$ inches, the depth $7\frac{1}{3}$ inches for the wheat firlot, and $10\frac{1}{2}$ for the barley-firlot. A ſtandard conſtructed by theſe meaſures is rather leſs than when regulated by the pint; and as it is difficult to make veſſels exactly cylindrical, the regulation by the pint has prevailed. and the other method gone into diſuſe.

If the Stirling jug contain $103\frac{1}{2}$ inches the wheat-firlot will contain 2109 inches; which is more than 2 *per cent.* larger than the legal malt-buſhel of England, and about 1 *per cent.* larger than the Wincheſter buſhel: and the barley-firlot will contain 3208 inches. The barley-boll is nearly equal to ſix legal malt buſhels.

In Stirlingſhire, 17 pecks are reckoned to the boll: in Invernesſhire, 18 pecks: in Ayrſhire, the boll is the ſame as the Engliſh quarter. And the firlots, in many places, are larger than the Linlithgow ſtandard.

3.] *French dry*, are, the litron, buſhel, minot mine, ſeptier, muid, and tun. The litron, is divided into two demilitrons, and four quarter-litrons, and contains 36 cubic inches of Paris. By ordonnance, the litron is to be three inches and a half high, and three inches 10 lines broad. The litron, for ſalt is larger, and is divided into two halves, four quarters, eight demi-quarters, and 16 meſurettes. The French buſhel is different in different juriſdictions. At Paris it is divided into demi-buſhels; each demi-buſhel into two quarts; the quart into two half-quarts; and the half-quart into two litrons: ſo that the buſhel contains 16 litrons. By ordonnance the Paris buſhel is to be eight inches two lines and a half high, and ten inches broad, or in diameter within-ſide. The minot conſiſts of three buſhels, the mine of two minots or ſix buſhels, the ſeptier of two mines or 12 buſhels, and the muid of 12 ſeptiers, or an 144 buſhels. The buſhel of oats is eſtimated double that of any other grain; ſo that there go 24 buſhels to make the ſeptier, and 288 to make the muid. It is divided into four picotins, the picotin containing two quarts, or four litrons. The buſhel for ſalt is divided into two half buſhels, four quarters, eight half-quarters, and 16 litrons; four buſhels make a minot, 16 a ſeptier, and 192 a muid. The buſhel for wood is divided into halves, quarters, and half-quarters. Eight buſhels make the minot, 16 a mine; 20 mines, or 320 buſhels, the muid. For plaſter, 12 buſhels make a ſack, and 36 ſacks a muid. For lime, three buſhels make a minot, and 48 minots a muid. The minot is by ordonnance to be 11 inches 9 lines high, and 14 inches 8 lines in diameter. The minot is compoſed of three buſhels, or 16 litrons; four minots make a ſeptier, and 48 a muid. The French mine is no real veſſel, but an eſtimation of ſeveral others. At Paris the mine contains ſix buſhels, and 24 make the muid; at Rouen the mine is four buſhels; and at Dieppe, 18 mines make a Paris muid. The ſeptier differs in different places: at Paris it contains two mines, or eight buſhels, and 12 ſeptiers the muid. At Rouen the ſeptier contains two mines or 12 buſhels. Twelve ſeptiers make a muid at Rouen as well as at Paris; but 12 of the latter are equal to 14 of the former. At Toulon the ſeptier contains a mine and a half; three of which mines make the ſeptier of Paris. The muid or muy of Paris conſiſt of 12 ſeptiers; and is divided into mines, minots, buſhels, &c. That for oats is double that for other grain. *i. e.* contains twice the number of buſhels. At Orleans the muid is divided into mines, but thoſe mines only contain two Paris ſeptiers and a half. In ſome places they uſe the tun in lieu of the muid; particularly at Nantes, where it contains 10 ſeptiers of 16 buſhels each. and weighs between 2200 and 2250 pounds. Three of theſe tuns make 28 Paris ſeptiers. At Rochelle, &c. the tun contains 42 buſhels, and weighs two *per cent.* leſs than that of Nantes. At Breſt it contains 20 buſhels, is equal to 10 Paris ſeptiers, and weighs about 2240 pounds. See Tun.

4.] *Dutch, Swediſh, Poliſh, Pruſſian,* and *Muſcovite.* In theſe places, they eſtimate their dry things on the foot of the *laſt, leſt, leth,* or *lecht;* ſo called according to the various pronunciations of the people who uſe it. In Holland, the laſt is equal to 19 Paris ſeptiers, or 38 Bourdeaux buſhels, and weighs about 4560 pounds; the laſt they divide into 27 mudes, and the mude into four ſchepels. In Poland, the laſt is 40 Bourdeaux buſhels, and weighs about 4800 Paris pounds. In Pruſſia, the laſt is 133 Paris ſeptiers. In Sweden and Muſcovy, they meaſure by the great and little laſt; the firſt containing 12 barrels, and the ſecond half as many. See Last. In Muſcovy, they likewiſe uſe the chefford, which is different in various places: that of Archangel is equal to three Rouen buſhels.

5.] *Italian.* At Venice, Leghorn, and Lucca, they eſtimate their dry things on the foot of the ſtaro or ſtaio; the ſtaro of Leghorn weighs 54 pounds 112 ſtaros and ſeven eights are equal to the Amſterdam laſt. At Lucca, 119 ſtaros make the laſt of Amſterdam. The Venetian ſtaro weighs 128 Paris pounds: the ſtaro is divided into four quarters. Thirty-five ſtaros and one-fifth, or 140 quarters and four fifths, make the laſt of Amſterdam. At Naples and other parts, they uſe the tomolo or tomalo, equal to one-third of the Paris ſeptier. Thirty-ſix tomoli and a half make the carro: and a carro and a half, or 54 tomoli, make the laſt of Amſterdam. At Palermo, 16 tomoli make the ſalma, and four mondili the tomola. Ten ſalmas and three-ſevenths, or 171 tomoli and three-ſevenths, make the laſt of Amſterdam.

6.] *Flemiſh.* At Antwerp. &c. they meaſure by the viertel; 32 and one half whereof make 19 Paris ſeptiers. At Hamburgh, the ſchepel; 90 whereof make 19 Paris ſeptiers.

7.] *Spaniſh and Portugueſe.* At Cadiz, Bilboa, and St Sebaſtian, they uſe the fanega; 23 whereof make the Nantes or Rochelle tun, or nine Paris ſeptiers and a half: though the Bilboa fanega is ſomewhat larger, inſomuch that 21 fanegas make a Nantes tun. At Seville, &c. they uſe the anagoras, containing a little more than the Paris mine; 36 anagoras make 19 Paris ſeptiers. At Bayonne, &c. the concha; 30 whereof are equal to nine Paris ſeptiers and an half. At Liſbon, the alqueire, a very ſmall meaſure, 240 whereof make 19 Paris ſeptiers, 60 the Liſbon muid.

Tables of Dry Meaſure.

1. English.

Solid inches					
33.6	Pint				
268.8	8	Gallon			
537.6	16	2	Peck		
2150.4	64	8	4	Buſhel	
17203.2	512	64	32	8	Quarter.

2. Scripture dry reduced to Engliſh.

							Peck.	Gal.	Pint.	Dec. Sol. inch.
Gachal							0	0	0$\frac{17}{12}$.	0.031
20	Cab						0	0	2 $\frac{5}{6}$	0.073
36	1$\frac{4}{5}$	Gomor					0	0	5 $\frac{1}{10}$	1.211
120	6	3$\frac{1}{3}$	Seah				1	0	1	4.036
360	18	10	3	Epha			3	0	3	12.107
1800	90	50	15	5	Leteeh		16	0	0	26.500
3600	180	100	30	10	2	Chomer or coron	32	0	1	18.969

3. Attic Meaſures of Capacity for Things dry, reduced to Engliſh Corn Meaſure.

							Peck.	Gal.	Pint.	Dec. Sol. inch.
Cochliarion							0	0	0	0.276$\frac{7}{10}$
10	Cyathos						0	0	0	2.763 $\frac{1}{2}$
15	1$\frac{1}{2}$	Oxybaphon					0	0	0	4.144 $\frac{3}{4}$
60	6	4	Cotyle				0	0	0	16.579
120	12	8	2	Xeſtes			0	0	0	33.158
180	18	12	3	1$\frac{1}{2}$	Choenix		0	0	1	15.705 $\frac{1}{4}$
8640	864	576	144	72	48	Medimnos.	4	0	6	3.501

4. Roman Meaſures of Capacity for Things dry, reduced to Engliſh Corn Meaſure.

							Peck.	Gal.	Pint.	Dec. Sol. inch.
Ligula							0	0	0$\frac{1}{48}$	0.01
4	Cyathus						0	0	0$\frac{1}{12}$	0.04
6	1$\frac{1}{2}$	Acetabulum					0	0	0$\frac{1}{8}$	0.06
24	6	4	Hemina				0	0	8$\frac{1}{2}$	0.24
48	12	8	2	Sextarius			0	0	1	0.48
384	96	64	16	8	Semimodius		0	1	0	3.84
768	192	128	32	16	2	Modius	1	0	0	7.68

Measure of Wood for Firing, is uſually the cord; four feet high, and as many broad, and eight long; this is divided into two half-cords, called *ways*, and by the French *membrures*, from the pieces ſtuck upright to bound them: or *voyes*, as being ſuppoſed half a waggon-load.

Measure for Horſes, is the hand, which by ſtatute contains four inches.

Measure, among botaniſts. In deſcribing the parts of plants, Tournefort introduced a geometrical ſcale, which many of his followers have retained. They meaſured every part of the plant; and the eſſence of the deſcription conſiſted in an accurate menſuration of the whole.

As the parts of plants, however, are liable to variation in no circumſtance ſo much as that of dimenſion, Linnæus very rarely admits any other menſuration than that ariſing from the reſpective length and breadth of the parts compared together. In caſes that require actual menſuration, the ſame author recommends, in lieu of Tournefoot's artificial ſcale, the following natural ſcale of the human body, which he thinks is much more convenient, and equally accurate.

The ſcale in queſtion conſiſts of 11 degrees, which are as follows: 1 A hair's-breadth, or the diameter of a hair (*capillus*.) 2. A line, (*linea*), the breadth of the creſcent or white appearnace at the root of the finger, (not thumb), meaſured from the ſkin towards the body of the nail: a line is equal to 12 hair-breadths, and is the 12th part of a Pariſian inch. 3. A nail, (*unguis*), the length of a finger-nail; equal to ſix lines, or half a Pariſian inch. 4. A thumb, (*pollex*), the length of the firſt or uttermoſt joint of the thumb: equal to a Pariſian inch. 5. A palm, (*palmus*), the breadth of the palm excluſive of the thumb; equal to three Pariſian inches. 6. A ſpan, (*ſpithama*,) the diſtance between the extremity of the thumb and that of the firſt finger when extended; equal to ſeven Pariſian inches. 7. A great ſpan, (*dodrans*) the diſtance between the extremity of the thumb and that of the little finger, when extended; equal to nine inches. 8. A foot, (*pes*), meaſuring from the elbow to the baſis of the thumb: equal to 12 Pariſian inches. 9. A cubit, (*cubitus*), from the elbow to the extremity of the middle finger: equal to 17 inches. 10 An arm-length, (*brachium*), from the arm-pit to the extremity of the middle finger; equal to 24 Pariſian inches, or two feet. 11. A fathom, (*orgya*), the meaſure of the human ſtature; the diſtance between the extremities of the two middle fingers, when the arms are extended; equal, where greateſt, to ſix feet.

Measure is alſo uſed to ſignify the cadence and time obſerved in poetry, dancing, and muſic, to render them regular and agreeable.

The different meaſures or metres in poetry, are the different manners of ordering and combining the quantities, or the long and ſhort ſyllables. Thus, hexameter, pentameter, iambic, ſapphic verſes, &c. conſiſt of different meaſures.

In Engliſh verſes, the meaſures are extremely various and arbitrary, every poet being at liberty to introduce any new form that he pleaſes. The moſt uſual are the heroic, generally conſiſting of five long and five ſhort ſyllables, and verſes of four feet; and of three feet and a cæſura, or ſingle ſyllable.

The ancients, by variouſly combining and tranſpoſing their quantities, made a vaſt variety of different meaſures. Of words, or rather feet of two ſyllables, they formed a ſpondee, conſiſting of two long ſyllables, a pyrrhic, of two ſhort ſyllables; a trochee, of a long and a ſhort ſyllable; and an iambic, of a ſhort and a long ſyllable.

Of their feet of three ſyllables they formed a moloſſus, conſiſting of three long ſyllables; a tibrach, of three ſhort ſyllables; a dactyl, of one long and two ſhort ſyllables; and an anepæſt, of two ſhort and one long ſyllable. The Greek poets contrived 124 different combinations or meaſures, under as many different names, from feet of two ſyllables to thoſe of ſix.

Measure in Muſic, the interval or ſpace of time which the perſon who beats time takes between the raiſing and falling of his hand or foot, in order to conduct the movement, ſometimes quicker, and ſometimes ſlower, according to the kind of muſic, or the ſubject that is ſung or played.

The meaſure is that which regulates the time we are to dwell on each note. See Time.

The ordinary or common meaſure is one ſecond, or 60th part of a minute, which is nearly the ſpace between the beats of the pulſe or heart; the ſyſtole, or contraction of the heart, anſwering to the elevation of the hand; and its diaſtole, or dilatation, to the letting it fall. The meaſure uſually takes up the ſpace that a pendulum of two feet and an half long employs in making a ſwing or vibration. The meaſure is regulated according to the different quality or value of the notes in the piece; by which the time that each note is to take up is expreſſed. The ſemibreve, for inſtance, holds one riſe, and one fall; and this is called the *meaſure*, or *whole meaſure*; ſometimes the *meaſure-note*, or *time note*: the minim, one riſe, or one fall: and the crotchet, half a riſe, or half a fall, there being four crotchets in a full meaſure.

Measure Binary or Double, is that wherein the riſe and fall of the hand are equal.

Measure Ternary or Triple, is that wherein the fall is double to the riſe: or where two minims are played during a fall, and but one in the riſe. To this purpoſe, the number 3 is placed at the beginning of the lines, when the meaſure is intended to be triple; and a C, when the meaſure is to be common or double. This riſing and falling of the hands was called by the Greeks *αρσις* and *θεσις*. St Auguſtine calls it *plauſus*, and the Spaniards *compas*. See Arsis and Thesis.

Powder Measures in Artillery, are made of copper, and contain from an ounce to 12 pounds; theſe are very convenient in a ſiege, when guns or mortars are loaded with looſe powder, eſpecially in ricochet firing, &c.

MEASURING, or Mensuration, is the uſing a certain known meaſure, and determining thereby the preciſe extent, quantity, or capacity of any thing.

Measuring, in the general, makes the practical part of geometry. From the various ſubjects whereon it is employed, it acquires various names, and conſtitutes various arts. See GEOMETRY, LEVELLING, TRIGONOMETRY, &c.

MEAT. See FOOD, DIET, DRINK, &c.

Amongſt the Jews, ſeveral kinds of animals were forbidden to be uſed as food. The fleſh with the blood, and the blood without the fleſh, were prohibited; the fat alſo of ſacrificed animals was not to be eaten. Roaſt meat, boiled meat, and ragouts, were in uſe amongſt the Hebrews, but we meet with no kind of ſeaſoning except ſalt, bitter herbs, and honey.—They never mingled milk in any ragout or haſh, and never eat at the ſame meal both meat and milk, butter or cheeſe. The daily proviſion for Solomon's table was 30 meaſures of fine wheat flour, 60 of common flour, 20 ſtalls of oxen, 20 paſture oxen, 100 ſheep, beſides veniſon and wild-fowl. See LUXURY.

The principal and moſt neceſſary food among the ancient Grecks was bread, which they called *αρτος*, and produced in a wicker baſket called *κανεον*. Their loaves were ſometimes baked under the aſhes, and ſometimes in an oven. They alſo uſed a ſort of bread called *Maza*. Barley meal was uſed amongſt the Greeks, which they called *αγφιτον*. They had a frequent diſh called *θριον*, which was a compoſition of rice, cheeſe, eggs, and honey, wrapped in fig-leaves. The *Μυττώτον* was made of cheeſe, garlic, and eggs, beaten and mixed together. Their bread, and other ſubſtitutes for bread, were baked in the form of hollow plates, into which they poured a ſauce. Garlic, onions, and figs, ſeem to have been a very common food amongſt the poorer Athenians. The Greeks, eſpecially in the heroical times, ate fleſh roaſted; boiled meat ſeldom was uſed. Fiſh ſeems not to have been uſed for food in the early ages of Greece. The young people only, amongſt the Lacedemonians, ate animal food; the men and the old men were ſupported by a black ſoup called *μελα ζυμος*, which to people of other nations was always a diſagreeable meſs. Graſshoppers and the extremities or tender ſhoots of trees were frequently eaten by the poor among the Greeks. Eels dreſſed with beet root was eſteemed a delicate diſh, and they were fond of the jowl and belly of ſalt-fiſh. Neither were they without their ſweet-meats: the deſert conſiſted frequently of fruits, almonds, nuts, figs, peaches. &c. In every kind of food we find ſalt to have been uſed.

The diet of the firſt Romans conſiſted wholly of milk, herbs, and roots, which they cultivated and dreſſed with their own hands; they alſo had a kind of gruel, or coarſe groſs pap, compoſed of meal and boiling water; this ſerved for bread: And when they began to uſe bread, they had none for a great while but of unmixed rye. Barley-meal was eaten by them, which they called *Polenta*. When they began to eat animal food, it was eſteemed a piece of luxury, and an indulgence not to be juſtified but by ſome particular occaſion. After animal food had grown into common uſe, the meat which they moſt frequently produced upon their tables was pork.

*Method of Preſerving Fleſh-*MEAT *without Spices, and with very little Salt.* Jones, in his *Miſcellanea Curioſa*, gives us the following deſcription of the Mooriſh *Elcholle*, which is made of beef, mutton, or camel's fleſh, but chiefly beef, and which they cut all in long ſlices, and let it lie for 24 hours in a pickle. They then remove it out of thoſe jars or tubs into others with water; and when it has lain a night, they take it out, and put it on ropes in the ſun and air to dry. When it is thoroughly dried and hard, they cut it into pieces of two or three inches long, and throw it into a pan or caldron, which is ready with boiling oil and ſuet ſufficient to hold it, where it boils till it be very clear and red when cut. After this they take it out, and ſet it to drain; and when all is thus done it ſtands to cool, and jars are prepared to put it up in, pouring upon it the liquor in which it was fried; and as ſoon as it is thoroughly cold, they ſtop it up cloſe. It will keep two years; will be hard, and the hardeſt they look upon to be the beſt done. This they diſh up cold, ſometimes fried with eggs and garlic, ſometimes ſtewed, and lemon ſqueezed on it. It is very good any way, either hot or cold.

MEATH, commonly ſo called, or otherwiſe *Eaſt* Meath, to diſtinguiſh it from the county called *Weſt* Meath: A county of Ireland, in the province of Leinſter, bounded by the counties of Cavan and Louth on the north, the Iriſh channel on the eaſt, Kildare and Dublin on the ſouth, and Weſt Meath and Longford on the weſt. It is a fine champaign country, abounding with corn, and well inhabited. It returns 14 members to parliament; and gives title of earl to the family of Brabanzan. It contains 326,480 Iriſh plantation acres, 139 pariſhes, 12 baronies, and ſix boroughs; chief town Trim. This diſtrict being the moſt ancient ſettlement of the Belgians in Ireland, the inhabitants were eſteemed the eldeſt and moſt honourable tribe from which ſeniority their chieftains were elected monarchs of all the Belgæ; a dignity that was continued in the Hy-n-Faillian without intermiſſion until the arrival of the Caledonian colonies, under the name of Tuath de Danan, when Conor-Mor, chieftain of theſe people, obtained or rather uſurped the monarchial throne, obliged Eochy Failloch, with ſeveral of his people, to croſs the Shannon, and eſtabliſh themſelves in the preſent county of Roſcommon, where Crothar founded the palace of Atha or Croghan, a circumſtance which brought on a long and bloody war between the Belgian and Caledonian races, which was not finally terminated until the cloſe of the 4th century, when the Belgian line was reſtored in the perſon of O'Nial the great, and continued until Briam Boromh uſurped the monarchial dignity, by depoſing Malachy O'Malachlin, about the year 1001. Tuathal Tetcthomar, by a decree of the Tarah aſſembly, ſeparated certain large tracts of land from each of the four provinces, where the borders joined together; whence under the notion of adopting this ſpot for demeſne lands to ſupport the royal houſehold, he formed the county or kingdom of Meath, which afterwards became the peculiar inheritance of the monarchs of Ireland. In each of the portions thus ſeparated from the four provinces, Tuathal cauſed palaces to be erected, which might adorn them, and commemorate the name in which they had been added to the royal domain. In the track taken out of Munſter, he built the palace called Flachtaga, where the ſacred fire, ſo called, was kindled, and were all the prieſts and druids annually met on the laſt day of October; on the evening of which day it was enacted, that no other fire ſhould be uſed throughout the kingdom, in order that all the fires might be derived from this, which being lighted up as a fire of ſacrifice, their ſuperſtition led them to believe would render all the reſt propitious and holy; and for this privilege every family was to pay threepence, by way of acknowledgment to the king of Munſter. The ſecond royal palace was erected in the proportion taken out of Connaught, and was built for the aſſembly called the convocation of Viſneach, at which all the inhabitants were ſummoned to appear on the 1ſt day of May, to offer ſacrifice to *Beal*, or *Bel*, the god of fire, in whoſe honour two large fires being kindled, the natives uſed to drive their cattle between them, which was ſuppoſed to be a preſervative for them againſt accidents and diſtempers, and this was called *Beal-Tinne*, or *Bel-Tine*, or the feſtival of the god of fire. The king of Connaught at this meeting claimed a horſe and arms from every lord of a manor or chieftain, as an acknowledgment for the lands taken from that province, to add to the territory of Meath. The third was that which Tailtean erected in the part taken from Ulſter, where the fair of that name was held, which was remarkable for this particular circumſtance, that the inhabitants brought their children thither, males and females, and contracted them in marriage, where the parents having agreed upon articles, the young people were joined accordingly; every couple contracted at this meeting, paid the king of Ulſter an ounce of ſilver by way of acknowledgement. The royal manſion of Tarah, formerly deſtroyed by fire being re-built by Tuathal, on the lands originally belonging to the king of Leinſter, was reckoned as the fourth of theſe palaces; but as a fabric of that name had ſtood there before, we do not find that any acknowledgment was made for it to the king of Leinſter.

Meath, with *Clonmacnois*, is a biſhop's ſee, valued in the king's books at L. 373 : 7 :0½; Sterling, by an extent returned *anno* 28th Elizabeth; but, by a former extent taken *anno* 30th Henry VIII. the valuation amounts to L. 373, 12 s. which being the largeſt and moſt profitable for the king, is the meaſure of the firſt fruits at this day. This ſee is reputed to be worth annually L. 3400. There were formerly many Epiſcopal ſees in Meath, as Clonard, Duleek, Kells, Trim, Ardbraccan, Donſhaghlin, Slaine, and Foure, beſides others of leſs note; all theſe, except Duleek and Kells, were conſolidated, and their common ſee was fixed at Clonard, before the year 1152; at which time the diviſions of the biſhoprics in Ireland was made by John Paparo, cardinal-prieſt, entitled cardinal of St Lawrence in Damaſo, then legate from Pope Eugene III. to the Iriſh. This diviſion was made in a Synod held on the 6th of March in the abbey of Mellifont, or, as ſome ſay at Kells; and the two ſees of Duleek and Kells afterwards ſubmitted to the ſame fate. The conſtitution of this dioceſe is ſingular, having no dean nor chapter, cathedral, or economy.—Under the biſhop, the archdeacon is the head officer, to whom, and to the clergy in general, the *congé d'elire* iſſued while biſhops were elective. The affairs of the dioceſe are tranſacted by a ſynod, in the nature of a chapter, who have a common ſeal, which is annually lodged in the hands of one of the body, by the appointment and vote of the majority. The dioceſe is divided into twelve rural deaneries.

Of CLONMACNOIS, *now annexed to Meath*: There is no valuation of this ſee in the king's books; but it is ſuppoſed to be included in the extent of the ſee of Meath, taken *anno* 30th Henry VIII. The chapter of this ſee conſiſted anciently of dean, chanter, chancellor, treaſurer, archdeacon, and twelve prebendaries, but moſt of the poſſeſſions of them have fallen into lay-hands. At preſent the deanery is the only part of the chapter which ſubſiſts, to which the prebend of Cloghran is annexed, and he hath a ſeal of office, which appears to have been the ancient Epiſcopal ſeal of this ſee. This ſee was founded by St Kiaran, or Ciaran, the younger, in 548 or 549 and Dermod; the ſon of Ceronill, king of Ireland, granted the ſite on which the church was built.

Weſt MEATH. See WESTMEATH.

MEATUS AUDITORIUS. See ANATOMY, nº 139.

MEAUX, an ancient town of France, in Brie, with a biſhop's ſee, ſeated in a place abounding in corn and cattle, on the river Marne, which divides it into two parts, and its trade conſiſts in corn, wool, and cheeſe. W. Long. 2. 58 N. Lat. 48. 58.

MECÆNAS, or MECOENAS (C. Cilnius), a celebrated Roman knight, deſcended from the kings of Etruria. He has rendered himſelf immortal by his liberal patronage of learned men and of letters; and to his prudence and advice Auguſtus acknowledged himſelf indebted for the ſecurity he enjoyed. His fondneſs for pleaſure removed him from the reach of ambition; and he preferred dying, as he was born, a Roman kight, to all the honours and dignities which either the friendſhip of Auguſtus or his own popularity could heap upon him. To the inference of Mecænas, Virgil owed the retribution of his lands; and Horace was proud to boaſt that his learned friend had obtained his forgiveneſs from the emperor, for joining the cauſe of Brutus at the battle of Philippi. Mecænas was himſelf fond of literature; and, according to the moſt received opinion, he wrote a hiſtory of animals, a journal of the life of Auguſtus, a treatiſe on the different natures and kinds of precious ſtones, beſides the two tragedies Octavia and Prometheus, and other things all now loſt. He died eight years before Chriſt; and on his death-bed he particularly recommended his poetical friend Horace to the care and confidence of Auguſtus. Seneca, who has liberally commended the genius and abilities of Mecænas has not with-held his cenſure from his diſſipation, indolence, and effeminate luxury. From the patronage and encouragment which the princes of heroic and lyric poetry among the Latins received from the favourite of Auguſtus, all patrons of literature have ever ſince been called *Mecænates*. Virgil dedicated to him his Georgics, and Horace his odes.

MECCA, an ancient and very famous town of Aſia, in Arabia the Happy; ſeated on a barren ſpot, in a valley ſurrounded with little hills, about a day's journey from the Red-Sea. It is a place of no ſtrength, having neither walls nor gates, and the buidings are very mean. That which ſupports it is the reſort of a great many thouſand pilgrims annually, for the ſhops are ſcarcely open all the year beſides. The inhabitants are poor, very thin, lean, and ſwarthy. The hills about the town are very numerous; and conſiſt of a blackiſh rock, ſome of them half a mile in circumference. On the top of one of them is a cave, where they pretend Mahomet uſually retired to perform his devotions, and hither they affirm the greateſt part of the Alcoran was brought him by the angel Gabriel. The town has plenty of water, and yet little garden-ſtuff; but there are ſeveral ſorts of good fruits to be had, ſuch as grapes, melons, water-melons, and cucumbers. There are alſo plenty of ſheep brought thither to be ſold to the pilgrims. It ſtands in a very hot climate; and the inhabitants uſually ſleep on the tops of their houſes for the ſake of coolneſs. In order to protect themſelves from the heat through the day, they carefully ſhut the windows, and water the ſtreets to refreſh the air. There have been inſtances of perſons ſuffocated in the middle of the town by the burning wind called *Simoom*.

As a great number of the people of diſtinction in the province of Hedsjas ſtay in the city. it is better built than any other in Arabia. Amongſt the beautiful edifices it contains, the moſt remarkable is the famous *Kaba*, or *Caaba*, "The houſe of God," which was held in great veneration by the Arabs even before Mahomet's time.

No Chriſtian dare go to Mecca; not that the approach to it is prohibited by any expreſs law, or that the ſenſible part of the Mahometans have any thing to object to it; but on account of the prejudices of the people, who, regarding this ground as ſacred, think Chriſtians unworthy of ſetting their foot on it; it would be profaned, in the opinion of the ſuperſtitious, if it was trod upon by infidels. The people even believe, that Chriſtians are prevented from approaching by ſome ſupernatural power; and they tell the ſtory of an infidel, who having got ſo far as the hills that ſurround Mecca, all the dogs of the city came out and fell upon him; and who, being ſtruck with this miracle, and the auguſt appearance of the Kaba, immediately became a muſſulman. It is therefore to be preſumed, that all the Europeans who deſcribe Mecca as eye-witneſſes, have been renegadoes eſcaped from Turkey. A recent example confirms this ſuppoſition. On the promiſe of being allowed to preſerve his religion, a French ſurgeon was prevailed on to accompany the Emir Hadsji to Mecca, in quality of phyſician: but at the very firſt ſtation, he was forced to ſubmit to circumciſion, and then he was permitted to continue his journey.

Although the Mahometans do not allow Europeans to go to Mecca, they do not refuſe to give them deſcriptions of the Kaba, and information with regard to that building; and there are perſons who gain their bread by making deſigns and little pictures of the Kaba, and ſelling them to pilgrims. See CAABA.

The Mahometans have ſo high an opinion of the ſanctity of Mecca, that they extend it to the places in the neighbourhood. The territory of that city is held ſacred to certain diſtances, which are indicated by particular marks. Every caravan finds in its road a ſimilar mark, which gives notice to the pilgrims when they are to put on the modeſt garb in which they muſt appear in thoſe ſacred regions. Every muſſulman is obliged to go once in his life, at leaſt, to Mecca, to perform his devotions there. If that law was rigourouſly enforced, the concourſe of pilgrims would be prodigious, and the city would never be able to contain the multitudes from all the countries where the Mahometan religion prevails. We muſt, therefore, ſuppoſe, that devotees alone perform this duty, and that the others can eaſily diſpenſe with it. Thoſe whoſe circumſtances do not permit a long abſence, have the liberty of going to Mecca by a ſubſtitute.—A hired pilgrim, however, cannot go for more than one perſon at a time; and he muſt, to prevent frauds, bring an atteſtation in proper form, from an Imam of Mecca, that he has performed the requiſite devotions on behalf of ſuch a perſon, either alive or dead; for after the deceaſe of a perſon who has not obeyed the law during his life, he is ſtill obliged to perform the journey by proxy.

The caravans, which are not numerous, when we conſider the immenſe multitude of the faithful, are compoſed of many people who do not make the journey from purpoſes of devotion. Theſe are merchants, who think they can tranſport their merchandizes with more ſafety, and diſpoſe of them more eaſily; and contractors of every kind, who furniſh the pilgrims, and the ſoldiers who eſcort the caravans, with neceſſaries. Thus it happens, that many people have gone often to Mecca, ſolely from views of intereſt. The moſt conſiderable of thoſe caravans is that of Syria, commanded by the Pacha of Damaſcus. It joins at ſome diſtance the ſecond from Egypt, which is conducted by a Bey, who takes the title of Emir Hadsji. One comes from Yemen, and another, leſs numerous, from the country of Lachſa. Some ſcattered pilgrims arrive by the Red Sea from the Indies, and from the Arabian eſtabliſhments on the coaſts of Africa. The Perſians come in that which departs from Bagdad; the place of conductor to this laſt is beſtowed by the Pacha, and is very lucrative, for he receives the ranſoms of the heretical Perſians.

It is of conſequence to a pilgrim to arrive early at the holy places. Without having been preſent from the beginning at all the ceremonies, and without having performed every particular act of devotion, a man cannot acquire the title of Hadsji: this is an honour very much coveted by the Turks, for it confers real advantages, and makes thoſe who attain it to be much reſpected. Its infrequency, however, in the mahometan dominions, ſhows how much the obſervation of the law commanding pilgrimages is neglected. A ſimilar cuſtom prevails among the Oriental Chriſtians, who are alſo exceedingly emulous of the title of Hadsji or Mokdaſi, which is given to pilgrims of their communion. In order to acquire this title, it is not ſufficient that the perſon has made the journey to Jeruſalem; he muſt alſo have kept the paſſover in that city, and have aſſiſted at all the ceremonies of the holy weeks.

After all the eſſential ceremonies are over, the pilgrims next morning move to a place where they ſay Abraham went to offer up his ſon Iſaac, which is about two or three miles from Mecca: here they pitch their tents, and then throw ſeven ſmall ſtones againſt a little ſquare ſtone building. This, as they affirm, is performed in defiance of the devil. Every one then purchaſes a ſheep, which is brought for that purpoſe, eating ſome of it themſelves, and giving the reſt to the poor people who attend upon that occaſion. Indeed theſe are miſerable ojects, and ſuch ſtarved creatures, that they ſeem ready to devour each other. After all, one would imagine that this was a very ſanctified place; and yet a renegado who went in pilgrimage thither, affirms there is as much debauchery practiſed here as in any part of the Turkiſh dominions. It is 25 miles from Jodda, the ſea-port town of Mecca, and 220 ſouth-eaſt of Medina. E. Long. 40. 55. N. Lat. 21. 45.

MECHANICAL, an epithet applied to whatever relates to mechanics: thus we ſay, mechanical powers, cauſes, &c. See the articles POWER, CAUSE, &c.

The mechanical philoſophy is the ſame with what is otherwiſe called *corpuſcular philoſophy*. See CORPUSCULAR.

This manner of reaſoning is much uſed in medicine; and, according to Dr Quincy, is the reſult of a thorough acquaintance with the ſtructure of animal bodies: for conſidering an animal body as a compoſition out of the ſame matter from which all other bodies are formed, and to have all thoſe properties which concern a phyſician's regard, only by virtue of its peculiar conſtruction; it naturally leads a perſon to conſider the ſeveral parts, according to their figures, contexture, and uſe, either as wheels, pullies, wedges, levers, ſcrews, cords, canals, ſtrainers, &c. For which purpoſe, continues he, it is frequently found helpful to deſign in diagrams, whatſoever of that kind is under conſideration, as is cuſtomary in geometrical demonſtrations.

For the application of this doctrine to the human body, ſee the article MEDICINE.

MECHANICAL, in mathematics, denotes a conſtruction of ſome problem, by the aſſiſtance of inſtruments, as the duplicature of the cube and quadrature of the circle, in contradiſtinction to that which is done in an accurate and geometrical manner.

MECHANICAL Curve, is a curve, according to Deſcartes, which cannot be defined by any algebraic equation; and ſo ſtands contradiſtinguiſhed from algebraic or geometrical curves.

Leibnitz and others call theſe mechanical curves *tranſcendental*, and diſſent from Deſcartes, in excluding them out of geometry. Leibnitz found a new kind of tranſcendental equations, whereby theſe curves are defined: but they do not continue conſtantly the ſame in all points of the curve, as algebraic ones do. See the article TRANSCENDENTAL.

MECHANICS.

IN the ſtrict ſenſe of the word, denotes the method of conſtructing machines to be ſet in motion, and to anſwer ſome uſeful purpoſes, by certain powers, either natural or artificial. According to this definition, the nature of the powers themſelves is not the object of mechanical inveſtigation, but rather the effect of them upon the paſſive bodies which we call *machines*: and the conſtructing of theſe in ſuch a manner, that the powers may act upon them with the leaſt poſſible obſtruction, and produce the intended effect to the greateſt advantage, is the perfection of MECHANICS.

It is uſual, in treatiſes upon this ſubject, to begin with an inveſtigation of the properties of *matter* itſelf, and of *central forces*; but the former is not to be inveſtigated by mechanical means, and the latter belong ſo much to aſtronomy, that very little needs to be ſaid upon them in this place; for which reaſon we refer to the articles ASTRONOMY, MATTER, and MOTION, for a diſcuſſion of theſe ſubjects. In treating of mechanics, therefore, we ſhall begin with a deſcription of what are commonly called the *mechanic powers*; and afterwards conſider the various ways in which they may be modified, in order to produce the effects expected from them.

SECT. I. *Of Material or Mechanical Power in general.*

§ 1. *Production of Motion and Reſt.*

In mechanics every thing is called a power which is capable of acting on a ſolid body; and every power which can act upon matter is ſuppoſed to be material, without regarding any abſtruſe ſpeculations concerning its nature. Hence the force of gravity, of electricity, of fire, of air, of water, the power of animals, of bodies preſſing or impinging with violence upon one another, are all accounted mechanical powers when applied to ſet machines in motion.

1
Reſt produced by the action of two oppoſite powers.

As any ſingle power, when applied to a material body, will ſet it in motion in proportion to its quantity, ſo the action of an oppoſite power upon the ſame body produces reſt. This may be eaſily conceived: for ſuppoſing two men to pull a log of wood with equal degrees of ſtrength in directions exactly oppoſite to one another, the log will remain immoveable. In like manner, if we put in a weight into one ſcale of a balance, motion will be produced; but reſt is the certain conſequence of counterpoiſing it with an equal weight in the oppoſite ſcale. When a weight is ſuſpended freely in the air, we are apt to imagine that it is acted upon by no force whatever; but we will ſoon diſcover our miſtake, by withdrawing the preſſure of the air from one ſide; for the body then, inſtead of remaining at reſt, will move with great violence to one ſide, and even contrary to the direction of gravity itſelf, unleſs it be extremely heavy. Whether reſt be in all caſes produced by the action of oppoſite powers upon the ſame ſubſtance, is a ſpeculation to be diſcuſſed under the article MOTION.

§ 2. *Of Reſiſtance.*

2
Ultimate cauſes of reſiſtance.

WHEN any moving power is ſtopped by a fixed obſtacle, ſo that it can proceed no farther, we ſay that it is *reſiſted* by that obſtacle. In this caſe we are apt to imagine that there is no force exerted by the reſiſting obſtacle; but it is found by experience, that *reſiſtance* is to all intents and purpoſes equivalent to a power equal and contrary to that which is impelled againſt the reſiſting obſtacle. This is exemplified in the caſe of a man ſtanding in a boat, and puſhing with a pole againſt the bank of a river or lake. In this caſe every one knows that the boat will go off in a direction contrary to that in which he puſhes; but if the boat be faſtened by means of a hook and a rope to that part of the pole which is between the man's body and the bank, the boat will remain immoveable by reaſon of the equality betwixt the action of the man upon the pole forward, and of the boat upon the ſame pole backward. Thus, in fig. 1. when the man puſhes with the pole C againſt the bank D, in the direction CA, the boat B will be carried away from the bank in the direction AC; but if, by means of the rope E, the boat be faſtened to the pole AC, the recoil of the boat in the direction AC will be juſt equal to the puſh given by the man in the direction CA, ſo that no motion will enſue let him exert ever ſo much ſtrength. Hence we ſee, that by means of a reſiſting obſtacle a power may be made to counteract itſelf, ſo that a motion or tendency to it may be produced in any direction; and in this caſe, as well as in the former, reſt is produced by the oppoſition of two contrary forces.

Plate CCLXXXII.

The very ſame effect would follow, though we ſhould ſuppoſe the man in the boat not to puſh againſt the bank or any fixed obſtacle, but againſt another boat faſtened by means of a rope to his own. In this caſe both the boats wil recede from each other till the rope be ſtretched; after which they will both remain immoveable, unleſs they be acted upon by ſome power external to both. If both boats be at liberty, they will mutually recede from each other till they get beyond the reach of the pole.

3
Reſiſtance equivalent to an oppoſing power.

Reſiſtance, whatever we may ſpeculate about it, ſeems ultimately to depend on the power of gravity joined with that of coheſion. Thus a weight of 100 pounds, even when ſuſpended in the freeſt manner we can imagine, will reſiſt much more than 20 pounds ſuſpended in the ſame manner; and though hard bodies reſiſt to a great degree, yet unleſs connected with ſome very heavy body, they are eaſily moved out of their place: and the immenſe gravitation of the whole globe of earth, we may juſtly ſuppoſe to be the ſource of all reſiſtance whatever to mechanical powers.

On the whole, therefore, we may conſider reſiſtance as an active power; but the action of which is confined to a very limited ſpace, or to the ſingle point of contact; though ſeveral experiments tend to ſhow, that even before actual contact bodies ſhow a very perceptible degree of reſiſtance.

§ 3. *Of the Communication of Power.*

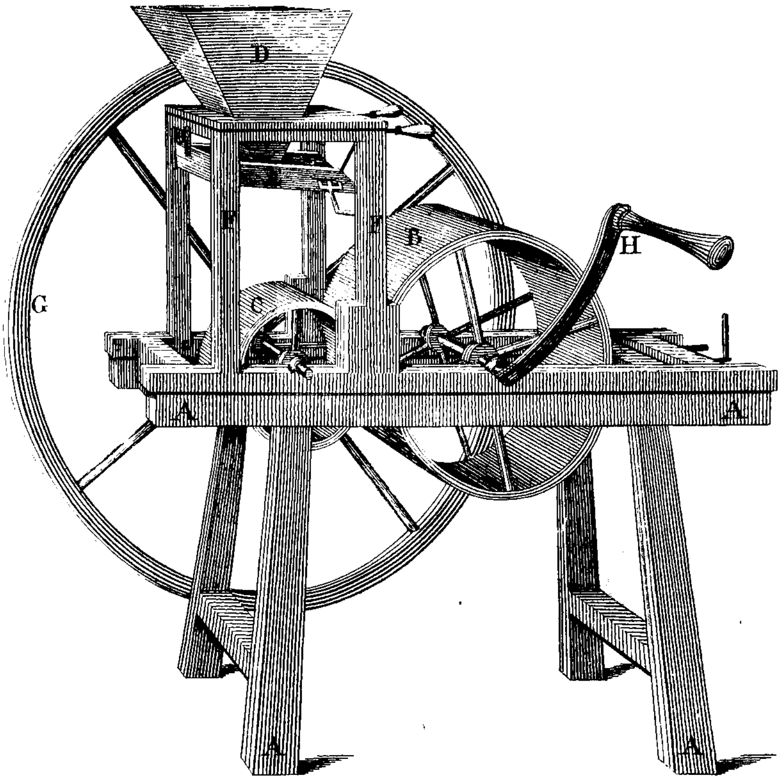
This depends entirely upon that property of bodies which is called their *attraction of coheſion*, and the immobility of their particles among themſelves; for if the parts of a body are abſolutely moveable among themſelves, they can neither communicate motion by impulſe nor by preſſure. The moſt common method of communicating motion in the mechanical way is by preſſure, which is generally accompliſhed by means of the ſix mechanical powers to be afterwards deſcribed: colliſion being employed only in certain particular caſes, the moſt remarkable of which will be pointed out under the article Motion.

The motion, which by means of an hard inflexible body is communicated to any other, may be confined to a ſingle point, or it may be diffuſed over any aſſignable ſpace. Thus, in fig. 2. let us ſuppoſe that any aſſignable power is applied to the point E, urging it from E towards D: the whole of that force will reſt upon the point of contact betwixt the ball C and the line BD. The weight, if placed exactly perpendicular to the horizon will remain upright, without inclining either to one ſide or other; for the power of reſiſtance in the line BD is exactly equal to the impulſe of the weight lying upon E; ſo that it is in the ſame ſituation with the man and boat in the firſt example, when he had the boat hooked to the pole with which he puſhed againſt the bank. If inſtead of oppoſing the end of the reſiſting body BD to the ball C, we place them in the poſition repreſented in fig. 3. then the whole of the power will reſt upon any point of the line BD we pleaſe. For if we ſuppoſe the line EC to drive the line BD before it in the poſition repreſented in the figure, it is plain that the whole force of that line will be diſcharged for a moment upon the line F, or upon any obſtacle we chooſe to put in its way in another part of the line; but if we place two ſupports or reſiſtances to the moving line BD, as F and G in fig. 4. it is equally plain, that one half of the power will reſt upon the one and one half upon the other. For the whole force urging forward the line BD is but a certain and determined quantity; and if divided betwixt two obſtacles, each of theſe muſt undoubtedly bear one half. In like manner, if, as in fig. 5. the power be oppoſed by four obſtacles, each of them will bear only one fourth part, and ſo on if we ſuppoſe it oppoſed by ever ſo many. For reaſons afterwards to be aſſigned, however, it is abſolutely neceſſary that the force on E act in a line directly perpendicular upon BD; that the obſtacles be all at equal diſtances, comparatively ſpeaking, from C; as H and I, F and G, &c. likewiſe that they be of exactly the ſame height; for thus only the preſſure, and conſequently the motion, can be made uniform in all parts. On this principle depends in a great meaſure the perfection of printing preſſes, oil preſſes, and all other machines intended to produce a violent and uniform preſſure upon any broad and flat ſurface.

As the preſſure upon a ſingle point may thus be diffuſed over a broad ſurface, ſo may that upon a broad ſurface be concentrated upon a ſingle point or a ſurface of ſmall dimenſion, as in fig. 6. Here it is plain that whatever preſſure is applied to the line AB, or any part of it in a perpendicular direction, muſt be ſuſtained by the point D; for if there was no reſiſtance, this point would be driven along with the line AB, and the moment it was ſtopped the power which urged it on muſt likewiſe be ſtopped. It is true, that unleſs the power act directly perpendicular to the point D, or the line CD be ſupported that it cannot move either to one ſide or to another, the impulſe will be but momentary; but of this we ſhall treat at large in the ſubſequent part of this article. On the principle juſt mentioned depends in a great degree the force on gimblets, augers, boring gimblets, &c.

§ 4. Of

A Malt Bruiser.



MECHANICS.

Fig: 1.

Fig: 3.

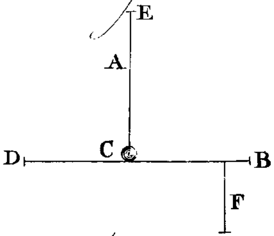


Fig: 4.

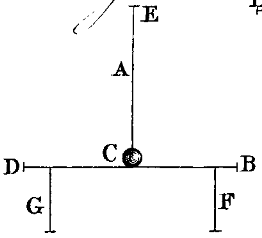


Fig: 6.

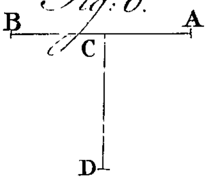


Fig: 2.

Fig: 9.

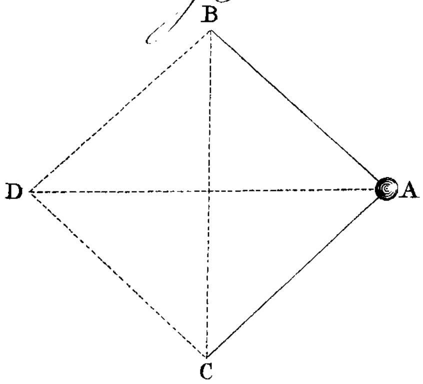


Fig: 10.

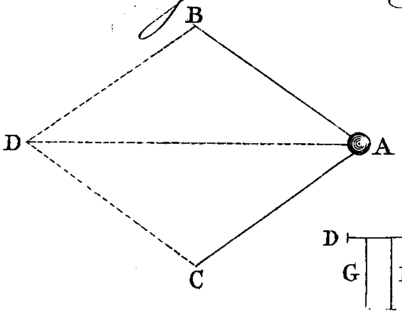


Fig: 5.

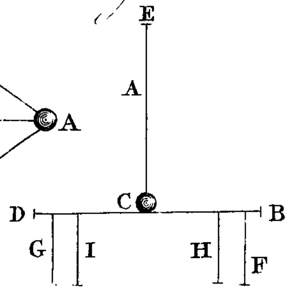


Fig: 7.

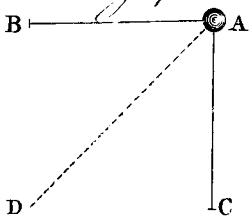


Fig: 8.

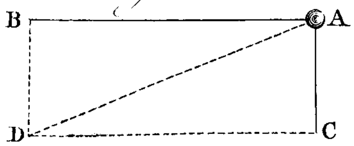


Fig: 11.

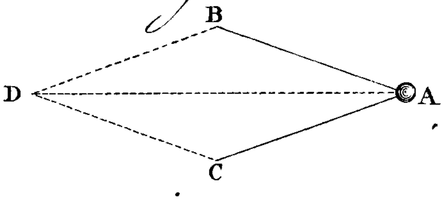
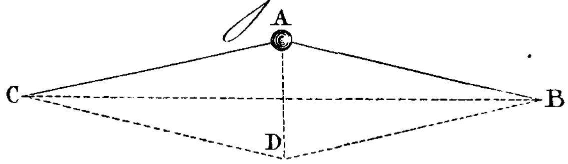


Fig: 12.



Thackara & Vallance sc.

§ 4. *Of changing the Direction of a Power into one directly oppoſite.*

This in all caſes is only to be accompliſhed by the application of a power greater than that of which we wiſh to change the direction. Thus, in fig. 2. ſuppoſe we wiſh to change the direction of the power at E from the direction AC to that of CA, we will find it impoſſible to do ſo by any other means than the application of a greater power from D towards C. If the two powers are equal, there will be no motion whatever; and the degree of motion produced at laſt will only be the difference betwixt the two powers. If it be wanted therefore to produce a power in the direction CA, equal and oppoſite to that in the direction AC, one muſt be applied in the direction CA double to the former. This principle is different from the firſt mentioned, in which motion is produced by puſhing againſt a fixed obſtacle while the moving power is not reſiſted on the oppoſite ſide; for here the power of gravity, or whatever we ſuppoſe to act upon E, reſiſts acording to its quantity, and the whole is in the ſituation of the boat when hooked to the pole fig. 1. To produce motion, therefore, a new force muſt be applied, as if a perſon was to puſh from the bank D againſt the hooked pole of the boat in that figure. The principle juſt now laid down does not militate againſt the apparent *aſcent* of bodies by the action of gravity, or the repulſion of elaſtic balls from one another by what is called the *power* of elaſticity. In both caſes a greater power is applied than the ſimple force of gravity, and with the exceſs of this power the body aſcends, as ſhall be afterwards ſhown.

§ 5. *Of the Motion produced by two or more Powers acting upon a Body in directions oblique to each other.*

As the action of two powers in direct oppoſition to each other is attended with the deſtruction of both if the powers are equal; and of one of them if they are unequal; ſo the action of powers directed obliquely upon one another is productive of motions in various directions, according to that of the acting powers.

The motion produced by the action of two powers is always in the diagonal of the parallelogram expreſſed by theſe powers. Thus, in fig. 7. let the body A be acted upon at once by two forces, one of which would carry it from A to B in the ſame time that the other would carry it from A to C. The body will then deſcribe AD, the diagonal of a ſquare, in the time that it would have deſcribed one of the ſides by a ſingle power applied to it. This is in conſequence of its obeying both forces; as it is evident that it has moved as far as from A to B, and likewiſe from A to C, which is preciſely the effect that the two powers would have had upon it ſeparately. In this caſe the body has acquired a greater power than it would have had from a ſingle power, but leſs than it would have acquired from the union of the two powers if they had acted directly in concert with each other: becauſe the diagonal of a ſquare is leſs than the ſum of the ſides, and the power with which any body moves is exactly proportioned to its velocity. If, inſtead of ſuppoſing the forces equal, we ſuppoſe one of them conſiderably greater than the other, then the greater force will carry the body farther in its own direction than the other, and the whole will be repreſented by a parallelogram, as in fig. 8. In this caſe it is evident that the body has moved exactly in conformity to the direction of both powers, *viz.* the whole length of AB, and the whole length of AC. In this caſe alſo the loſs of motion is leſs than in the former; becauſe the length of the oblong parallelogram approaches much nearer to the ſum of the ſides than the diagonal of a ſquare; and the greater inequality there is betwixt the ſides, the leſs power is loſt.

If, inſtead of acting at right angles to each other, the direction of the powers forms an acute angle, as in figs. 9. 10. 11. the power produced will be conſiderably greater than either of the original ones; and the more acute the angle is, the greater will be the augmentation, as is evident from an inſpection of the figures. The reaſon of this, though not quite ſo obvious, is the ſame with the former. Thus the body A in fig. 9. had it been acted upon by only one power, *viz.* that denoted by AB, would have been at B, or carried as far forward as E, the half of the diagonal; its oblique direction upward not being taken into the account. Had it been acted upon by the force AC alone, it would have been at C with an obliquity as far down as the other is up. As theſe obliquities, however, are in contrary directions, they muſt of neceſſity deſtroy one another; and therefore the body moves neither to one ſide nor another, but proceeds with the ſum of the direct forces of the powers, or thoſe by which they move in the ſtraight diagonal. But either of the two powers would have brought it forward as far as E; of conſequence both conjoined muſt carry it on to D, the whole length of the diagonal. Thus it appears, that when a body is acted upon by two powers which partly conſpire together, the power produced will be the exact ſum of them as far as they do conſpire, and the loſs ariſes entirely from the oppoſition betwixt them; for all powers which do not directly conſpire, oppoſe one another in a certain degree. Hence when the acting forces make an obtuſe angle with each other, as in figs. 12, 13, there is then a very great loſs of power, becauſe there is ſuch an oppoſition betwixt them; and it is only that ſmall part of their motion which acts in concert that can produce any in the body acted upon: but this, as in the former caſe, is exactly double to what it would be if only one of them acted upon the body. Thus, in fig. 12. the whole direction of the powers from E to B, and from B to C, is in abſolute oppoſition to each other: and therefore, ſuppoſing them equal, muſt be totally loſt. In the direction AD they conſpire; and therefore the body will move twice as far in that direction as is expreſſed by that of the lines in the figure; that is, from A to D, inſtead of only from A to E, wich is the limit of each of the forces. In caſes of this kind, the more obtuſe the angle is at which the forces act, the greater is the loſs of power, as is evident from an inſpection of figs. 12, 13.

Plates CCLXXXII. CCLXXXIII.

4 Oppoſition betwixt two powers acting at right angles pointed out.

Some who are but beginning to the ſtudy of mechanics may be embarraſſed in their ideas how two forces acting at right angles to each other can in any manner of way oppoſe each other, as in fig. 7; as we find that a body deſcending by the force of gravity

Plate cclxxxiii.

may be puſhed to a ſide ſeemingly by the leaſt force imaginable. But this will eaſily be underſtood from fig. 14. which is only a ſquare turned into another poſture. Here it is plain that the powers AB and AC oppoſe each other as much as they conſpire; that is in the proportion of half the diagonal of the ſquare: this quantity therefore is totally loſt, and the body proceeds with the other half: which being doubled on account of each of the powers proceeding with one half of the diagonal, gives the whole diagonal for the total motion produced.

5
Ultimate cauſe of this ſhown.

But however plain this may appear from an inſpection of the figure, it is by no means ſo apparent when we come to try it by numbers. Thus, ſuppoſing each of the ſides AB and AC to be 5, the diagonal of the ſquare will be nearly 7.071; but if from the ſum of the ſides 10 we take this number, or half of it from each number, we will have only 2.919 for the whole motion, inſtead of the diagonal 7.071 which is the reality. From an inſpection of the figure alſo we plainly ſee, that if one diagonal is gained by the powers conſpiring together or acting in concert, another is loſt by their oppoſition. It is natural therefore to inquire, How can any two powers gain or loſe more than their own quantity; for the two powers taken together amount but to *ten*, but the two diagonals, one of which is gained and the other loſt, amount between them to upwards of *fourteen!* To ſolve this ſeeming paradox, we muſt conſider, that as the diagonal of the ſquare ABCD, fig. 14. is generated from the two ſides AB and CD, ſo theſe ſides themſelves may be accounted the diagonals of two other ſmaller ſquares *a*BAE and AE*b*C, fig. 15. each of the ſides of which is half the diagonal of the large one. From the ſum of the ſides of theſe ſquares, which to the large ſquare are the ſource of power, it is evident that a diagonal may be taken and another remain, becauſe each of the ſides is half a diagonal.

6
All powers are compounded of others.

Hence we not only ſee that every mechanical power we are acquainted with *may be* derived from two others, but have a demonſtration that it *actually is ſo*; not only becauſe this ſuppoſition explains the phenomena, but becauſe we are involved in an inexplicable contradiction if we ſuppoſe any thing elſe, for no power can loſe more than its own quantity: and if it loſes more than one half, it can never produce effects equivalent to another half; which we ſee muſt be the caſe, if we ſuppoſe any two *unoriginated* powers acting upon one another at right angles, or indeed any other way, though the ſuppoſition of their acting at right angles makes the matter more plain than any other. This leads to a very curious ſpeculation concerning the origin of mechanical motion, of which an account is given under the article MOTION.

7
Experiment illuſtrating the truth of this doctrine.

Hitherto we have conſidered both the powers not only as equal at the beginning, but as continuing ſo throughout their whole courſe: but this is a ſuppoſition which ſcarcely exiſts in nature, unleſs the powers are kept from exerting themſelves otherwiſe than by ſimple preſſure. Thus, in fig. 16. ſuppoſing the body A pulled in the direction AB by the weight D of five pounds put over the fixed pin B, and pulled in the direction AC by C, another weight of five pounds faſtened to it by a ſtring; the whole will be kept in the poſition repreſented in the figure by a weight of 7.071 pounds faſtened to it by a ſtring, and put over the pin F, ſituated any where in the diagonal line FAG; and let us add ever ſo much weight, provided it be done to D and C in the proportion of five, and to E in that of 7.071, the body A will remain ſuſpended in the air without altering its poſition in the leaſt.

If, inſtead of making the weights equal, we make one exceed the other in any proportion, the weight neceſſary to counteract them will never be required equal to both, but will always be in proportion to the diagonal of the parallelogram of which the weights repreſent the ſides. Thus, in fig. 17. if we ſuppoſe the body A pulled in the direction AB by the weight G of four pounds, and in the direction AC by the weight H of three pounds, it will be kept ſuſpended by the weight F of five pounds put over the pin E, placed any where in the diagonal line EAD. For the diagonal AD is equal (by Prop. 47. Book 1. of Euclid) to the ſquare-root of the ſum of the ſquares of the ſides AB and AC, or CD and BD. But the ſquare of AB is $4\times4=16$ pounds, and that of AC is $3\times3=9$ pounds by the ſuppoſition; and $16+9=25$, the ſquare-root of which is 5; and theſe proportions will be found to hold invariably in whatever way we apply mechanical powers; though, when they act at oblique angles, the diagonals muſt be calculated by other methods.

8
Curvelinear motion how produced.

If, however, we ſet any of the powers at liberty, we ſhall find that none of them will continue the ſame even for a moment. If we ſuppoſe any of them to be the power of gravity, which is the moſt conſtant and equable we are acquainted with, this is found to increaſe prodigiouſly; and, on the other hand, if we ſuppoſe one of them to be a projectile force, as of a ſtone thrown by the hand, we find in like manner, that it will be diminiſhed to a great degree in a very little time. In all caſes, however, where a body is acted upon by two forces either increaſing or decreaſing, unleſs both increaſe or decreaſe exactly in proportion to their original quantity, the body acted upon will deſcribe a curve. Thus, in fig. 18. ſuppoſe the body A to be acted upon by two equal powers A*b* and A*c*; at the end of the firſt moment it will be at *d*, the end of the diagonal of the ſmall ſquare A*bcd*: but if now the force A*c* be increaſed to double what it was in the preceding moment, the body will at the end of the ſecond moment be at *g*, the extremity of the parallogram *defg*: and by another increment of the ſame power, will be at the end of the third moment at *k*, and ſo on. This is ſimilar to the motion of falling bodies, of which we ſhall treat hereafter; but if one of the powers diminiſhes inſtead of increaſing, the phenomena will be different. Thus in fig. 19, ſuppoſing the body at A to be actuated the firſt moment by the two forces A*b* and A*c*; at the end of that moment it will be at the extremity of the diagonal A*d*; but next moment, ſuppoſing the power A*c* to be diminiſhed one half, the other remaining the ſame, it will then be at *g*, and the third moment at *k*; thus deſcribing another kind of curve. If, while one of the powers decreaſes the other increaſes, a third kind of curve will be generated; and by proper management of theſe powers, the body may be made to deſcribe the ſegment of a circle, as in fig. 20: where

where it is manifeſt that one power continually decreaſes while the other increaſes.

9 Machine for ſhowing the action of oblique powers. Fig. 21.

The following machine has been contrived to illuſtrate the operation of oblique powers upon each other. ABCD is a wooden ſquare, ſo contrived that the part BEFC may draw out from it or be puſhed back at pleaſure. To this is joined a pully H, freely moving upon its axis, which will be at H when the piece is puſhed in, and at *h* when it is drawn out. To this part let the ends of a ſtraight wire *k* be fixed, ſo as to move along with it under the pulley; and let the ball G be made to ſlide eaſily upon the wire. A thread *m* is fixed to this ball, and goes over the pulley to I; by which means the ball may be drawn up on the wire parallel to the ſide A D, when the part BEFC, is puſhed as far as it will go into the ſquare: but when this part is drawn out, the ball muſt be carried along with it parallel to the bottom of the ſquare DC. Thus the ball may be drawn either perpendicularly upward by pulling the thread *m*, or moved horizontally by pulling out the part BEFC, in equal times and through equal ſpaces, each power acting equally and ſeparately upon it. But if, when the ball is at G, the upper end of the thread be tied to the pin I, in the corner A of the fixed ſquare, and the moveable part BEFG be drawn out, the ball will then be acted upon by both the powers together: for it will be drawn up by the thread towards the top of the ſquare, and at the ſame time carried with its wire *k* towards the right hand BC, moving all the while in the diagonal line L, and will be found at *g* when the ſliding part is drawn out as far as it was before; which then will have cauſed the thread to draw up the ball to the top of the inſide of the ſquare juſt as high as it was before when drawn up ſingly by the thread without moving the ſliding part.

10 Of bodies acted upon by three forces.

If a body is acted upon by three forces, the inveſtigation becomes ſomewhat more complex, though it is ſtill eaſily explained on the foregoing principles. Thus, in fig. 22. let the body A be pulled ſidewiſe in oppoſite directions by the two equal weights G G put over the pins B and C, and directly downward by the weight H, the ſame with G. In this caſe it is plain that each of the weights G and G ſuſtain one half of the weight H; and as both taken together are double in quantity to H, it might be ſuppoſed that they would be abundantly able to keep the body A in its poſition. The caſe, however, is very different. As each of the weights G ſuſtains only one half of H, it follows that A acts only with one half of its weight upon them. The body A. therefore, is pulled in the direction AC and AB by two powers, each of which is as 2, and in the direction AF by two, which are only as one. With the force AB, therefore, were it to act upon it ſingly, it would deſcribe the diagonal AD, and with that AC it would deſcribe the diagonal AE. Theſe two diagonals are in truth the forces by which it is now actuated, and the effect is preciſely according to the principles already laid down. By each of them taken ſeparately, the body would be brought down to F; their lateral action being in oppoſite directions deſtroys itſelf: and by their conjunct action, the body would be brought down to double the ſpace AF, that is to H, and conſequently would deſcribe the diagonal of the ſmall ſquare ADHE; which diagonal is equal to the ſide of the large one, and the very ſame that the body would have deſcribed though the two lateral weights had not been preſent.

Hence it appears, that though we pull a body ever ſo ſtrongly by ſtrings in a direction oppoſite to each other, it will ſtill require an equal weight to retain it in equilibrio; that is, ſuppoſing the ſtrings to be perfectly flexible. There may indeed be a deception in making an experiment of this kind; for the body will never deſcend as far as H, nor near that diſtance; but then it muſt be obſerved, that when the ſtrings begin to bend in the middle, the weights G G act in a direction different from what they did originally, and pull the body upwards inſtead of laterally: in which caſe, it muſt either remain at reſt, as in fig. 23. or move upwards, as in fig. 24.

When the powers act in rhe direction AB and AC, fig. 23. one half of the weight H is ſuſtained by each of them. The body is therefore pulled in the directions AB and AC by two powers, each of which is as 2; and in the direction AF by other two, each of which is as 1. By the power AB it would be made to move in the diagonal AD of the parallelogram ABDF; and by the power AC, in the diagonal AE of the parallelogram ACFE; but theſe diagonals are equal and contrary to each other, and therefore deſtroy each other; of conſequence the body remains at reſt.

In fig. 14. the body A with the weight H appended to it is placed nearer to the point B than to C by one third. Of conſequence, as will afterwards be explained, it bears two-thirds of the weight H, while C ſuſtains only one-third. The acting powers, therefore, are now the diagonals of two unequal parallelograms. One power draws the body in the direction AB with a force as 3, while the weight H draws it in the direction AH with a force as 2. By it, therefore, the body would be drawn in the direction of the diagonal AD of the parallelogram BDEA. On the other hand, it is acted upon by the power AC, which is likewiſe as 3, while the weight H draws it down with a force only as 1. By this, therefore, it would be drawn in the direction of the line AG, the diagonal of the parallelogram ACGF. We muſt now make theſe two diagonals the ſides of a third parallelogram ADIG; and in the diagonal AI of this parallelogram it will go, for the reaſons already given.

11 Of bodies acted upon by four or more forces.

If four or more forces act upon a body in different directions, the caſe becomes very complicated; and if many powers be employed, it will by no means be eaſy to determine *a priori* which way the body will tend. Caſes of this kind, however, ſeldom occur in practical mechanics; and when they do, it will be better to determine them by actual experiment than by a tedious inveſtigation, which, after all, may be liable to a miſtake. We forbear, therefore, to give more examples; though if the reader inclines to exerciſe his ingenuity, he muſt proceed upon the plan already laid down, viz. by combining the different powers together; forming diagonals from theſe parallelograms; combining theſe diagonals into a third ſet of parallelograms; and the diagonals thence reſulting into a fourth ſet, &c. until at laſt a ſingle one is met with prevailing over all the reſt or two deſtroying each other. If one prevails, the

Mechanical Power.

body will move in that direction; but if two deſtroy each other, the body will remain at reſt.—It muſt alſo be obſerved, that in making drawings of this kind, the longeſt line always repreſents the greateſt power, and that without a ſingle exception to the contrary. By mere mechanical conſtruction therefore, with ſcale and compaſs, we may be able to aſcertain the direction of oblique powers to as great accuracy as we can ever have occaſion for in practice.

12
Of the various ways in which powers may be produced,

We ſhall conclude this ſubject with obſerving that as every power certainly *is* produced by the action of two others, ſo it *may be* by innumerable others. Thus, in fig. 25. the power AD may be produced by the two ſides of the ſquare ABDC; by the ſides of the oblique-angled parallelogram A*a*D*d*, of the ſmaller parallelogram A*c*D*d*; or of the large parallelogram AE, DF, &c. Hence it is eaſy to produce any power, whether ſtrong or weak, from the action of any two powers whoſe direction we have at our command, without regard to their quantity. If we make the generating powers conſpire together, a ſtrong one will be produced; or if they oppoſe each other to a certain degree, they will produce a weak one. The ſtrongeſt that can be produced by any two powers is when they act the ſame way in a direct line.

§ 6. *Of the Relation Betwixt Velocity and Power.*

HITHERTO we have ſuppoſed the bodies to be moved not to make any reſiſtance to motion in any direction, unleſs oppoſed by a fixed obſtacle; in which caſe, *velocity* and power would be the ſame thing; and thus it always appears to be when we repreſent powers by lines upon paper. But when we come to practice, matters turn out very different. A ball of cork moving with any degree of velocity will not have an equal power with one of wood moving with the ſame volocity: neither will a wooden ball have the ſame power with a metallic one. Among the metals themſelves, too, there is a difference; for the lighter metals are inferior in power to the heavier ones. Gravity, therefore, muſt be accounted the power which gives to moving bodies what we call their *force* or *momentum*; for according to the weight of a body, ſo will its impulſe always be, and that whether it moves upwards, downwards, ſidewiſe, or in a circle. The abſolute power of a body, therefore, muſt be meaſured by comparing the gravity of different bodies together, and denoting one of them by unity: making the other 2, 3, 4, &c. according as it is twice, thrice or four times, the ſpecific gravity of the former. Thus let an hollow ball of metal be filled with water; if the ball be very thin, we may let its weight paſs unnoticed, or we may make allowance for it in the calculation. Suppoſing the weight of this ball then to be 1, if it moves with a velocity of 10 feet in a ſecond, its abſolute force or momentum will be $10\times1=10$; a ball of ſtone of equal ſize which weighs three times as much as the former, if moved with an equal velocity, will have a force of $10\times3=30$; a ball of tin which weighs 7 times as much, will have a momentum of 70; and a ball of gold or platina would have a momentum of 190 or 200.

This will alſo hold exactly, by increaſing the *quantity* of matter, where it is deficient in ſpecific gravity. Thus, if the hollow metallic ball, be increaſed in diameter, ſo that it ſhall equal in weight the ball of ſtone or of metal, it will have the very ſame force with that ball; and in like manner, it might be made to have a momentum equal to the metallic balls, though not without a very conſiderable increaſe of ſize.—Great maſſes of matter will therefore ſupply the place of great velocity: and hence Mr Atwood obſerves, that the battering rams uſed by the ancients were no leſs powerful in beating down the walls of cities than the modern artillery.

13
Mr Atwood's obſervations on the ancient battering-rams,

"The battering-rams of the ancients (ſays he) conſiſted of very large beams of wood terminated by ſolid bodies of braſs or iron; ſuch a maſs being ſuſpended as a pendulum, and driven partly by its gravity and partly by the force of men againſt the walls of a fortification; exerted a force which, in ſome reſpects, exceeded the utmoſt effects of our battering cannon, though in others it was probably inferior to the modern ordnance. To compare the effects of the battering-ram, the metal extremity of which ſuppoſe equal to a 24 pounder with a cannon-ball of 24 pounds weight; in order that the two bodies may have the ſame effect in cutting a wall or making a breach in it, the weight of the aries muſt exceed that of the cannon ball in proportion of the ſquare of 1700, the velocity of the ball*, to the ſquare of the velocity with which the battering-ram could be made to impinge againſt the wall expreſſed in feet. If this may be eſtimated at 10 feet in a ſecond, the proportion of the weights will be that of about 2,890,000 to 100, or of 28,900 to 1; the weight of the battering-ram therefore muſt be 346 ton. In this caſe the battering-ram and the cannon-ball, moving with the velocities of 10 and 1700 feet reſpectively in a ſecond, would have the ſame effect in penetrating the ſubſtance of an oppoſed obſtacle; but it is probable that the weight of the aries never amounted to ſo much as is above deſcribed; and conſequently the effects of the cannon ball to cut down walls by making a breach in them, muſt exceed thoſe of the ancient battering-rams: but the momentum of theſe, or the impetus whereby they communicated a ſhock to the whole building, was far greater than the utmoſt force of cannon-balls; for if the weight of the battering-ram were no more than 1700 times greater than that of a cannon-ball, each moving with its reſpective velocity, the moments of both would be equal; but as it is certain that the weight of theſe ancient machines was far more than 1700 times our heavieſt cannon-balls, it follows, that their moment or impetus to ſhake or overturn walls, &c. was far ſuperior to that which is exerted by the modern artillery. And ſince the ſtrength of fortifications will in general be proportioned to the means which are uſed for their demolition, the military walls of the moderns have been conſtructed with leſs attention to their ſolidity and maſſy weight than the ancients thought a neceſſary defence againſt the aries; that ſort of coheſive firmneſs of texture which reſiſts the penetration of bodies being now more neceſſary than in ancient times; but it is manifeſt, that even now ſolidity, or weight in fortifications alſo is of material conſequence to the effectual conſtruction of a wall or battery." This difference between the momentum and force of penetration is exemplified in knives, wedges, or

any

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* See the article *Gunnery*.

any ſharp inſtruments, where a ſudden blow will cauſe a much deeper penetration than a weight vaſtly greater than could be ſtirred from the earth by the force of the blow.

§ 7. *Of the Multiplication and Increaſe of Power.*

We have now ſeen that *power*, abſolutely ſo called, acts in a kind of double capacity, *viz.* either when it impreſſes a great velocity upon a ſmall quantity of matter, or when it impreſſes a ſmall velocity upon a great quantity of matter. It muſt, however, be remarked, that the matter we ſpeak of is always ſuppoſed ſubject to the laws of gravity; for what would be the conſequence of putting a body in motion which had no gravity we cannot poſſibly conceive, becauſe we never ſaw any ſuch body. Philoſophers indeed mention the *vis inertiæ* of matter as property diſtinct from gravity; but the arguments in favour of this property are now generally looked upon to be inconcluſive, and gravity and the *vis inertiæ* looked upon to be the ſame.

The two modes in which abſolute power acts, come preciſely to the ſame thing whether the velocity be great or ſmall: for it is evident, that when two pounds move with the velocity of 1, it is the ſame thing with one pound moving with the velocity of 2; the *velocities* as well as powers being exactly the ſame. But there is a third way in which power may be directed, in which it has not the relation to velocity already mentioned; and that is, by ſimple preſſure, where no motion is admitted. Thus may the ſmalleſt power be made to augment itſelf to an inconceivable degree, as in fig. 26. Here, ſuppoſe the body A to preſs directly downwards upon the line AB faſtened to the ſmall wheel B, moveable upon an axis. If we ſuppoſe the extremity of the line at A to be ſupported ſo that it ſhall not fall to a ſide, the wheel B will preſs downward with the whole of the weight A upon the line EF, and conſequently the line *g* muſt ſuſtain the whole of this weight. But if the line EF be ſupported ſo that cannot move perpendicularly downwards to *g*, it will then roll along the line EF from B towards F; and this tendency to roll in the direction juſt mentioned will be exactly equivalent to the weight A. Any body therefore laid on the top of a ſtick ſet up at an angle of 45 degrees, will require a power double to its own weight to keep it ſteady at the foot, abſtracting from that which will be neceſſary to prevent it from falling to a ſide.

If now we ſuppoſe the wheel B to preſs laterally upon another C; and that other, by means of the line CD and wheel D, to preſs upon the two obſtacles *i* and *k*, both of which it touches at an angle of 45 degrees; it is plain that not only each of theſe obſtacles muſt bear the whole weight of the body A, but the reaction of the wheel D will preſs down the wheel C in the direction C*h* with the very ſame force that D is preſſed upwards. This is entirely ſimilar to the caſe of the man in the boat repreſented in fig. 1. Thus the weight A produces a preſſure equal to five times its own weight; and by multiplying the wheels and rods, we might increaſe the preſſure as much as we pleaſe. The caſe is ſimilar to that in hydroſtatics, where a little quantity of liquid may be made to burſt the ſtrongeſt veſſel.

Plate CCLXXXII.

Sect. II. *Of the Mechanical Powers.*

By theſe we underſtand ſuch ſimple machines as are uſeful for comparing the velocity of various bodies together, and impreſſing them with greater or ſmaller degrees of it at pleaſure; by which means we may either cauſe a ſmall weight overcome a great one, or by means of a great one we may make a ſmall weight move through a ſpace proportionably great. Thus by means of ſome of theſe powers, indeed by any of them, we may cauſe a weight of one pound, by moving through the ſpace of ten feet, raiſe another of ten pounds through one foot; or *vice verſa*, by a weight of ten pounds moving through the ſpace of one foot, we may make a ſingle pound move through the ſpace of ten feet; but by none of the powers will we be able, by moving a weight of ten pounds through one foot, to move a ſingle pound through 11 feet; nor by a ſingle pound moving through a ſpace of nine feet will we be able to raiſe a weight of ten pounds through the ſpace of one foot. None of the mechanic powers, as they are called, therefore, can make any abſolute increaſe of the power applied; all that they can do is to alter the velocity of the power applied, and thus transfer it either to a larger or ſmaller body at pleaſure; and upon this principle depends the whole practical part of mechanics. The mechanical powers are ſix in number, *viz.* the *lever*, *wheel in axis* or *axis in peritrochio*, the *pulley*, *inclined plane*, *wedge*, and *ſcrew*, of all which we ſhall now treat particularly.

§ 1. *Of the Lever.*

14
Firſt kind of lever.
Plate CCLXXXIII.

This is the moſt ſimple of all the mechanical powers, and is uſually no other than a ſtraight bar of wood or iron ſupported by a prop, as in fig. 27. The weight to be raiſed is ſuſpended at the ſhort arm of the lever A; and exactly in the inverſe proportion of the diſtance of the weight from the fulcrum or prop C, is the quantity of the weight at B neceſſary to keep it in equilibrio. Thus if the weight at A be diſtant one foot or one inch, it ſignifies nothing which, from the prop, it will require an equal weight placed at the ſame diſtance on the other ſide, as at 1, to balance it; but if the latter be placed at 2, then only half the weight ſuſpended at A will balance it: if the ſmall weight is placed at 3, then only one third will be neceſſary; if at 4, only one fourth, &c. and if, as in the figure, it be removed to 10, then only one-tenth part will be required to make a balance. It muſt ſtill be remembered, however, that if the lever is put in motion, the ſmall weight muſt move through a ſpace ten times as great as that through which the large one moves; ſo that in fact there is not any acquiſition of power by means of the lever, though it is one of the inſtruments moſt commonly uſed in mechanics, and very ſerviceable in looſening ſtones in quarries, or raiſing great weights to a ſmall diſtance from the ground; after which they may be raiſed to greater heights by other machines.

In making experiments with this kind of lever, it is neceſſary either to have the ſhort arm much thicker than the long one, ſo that it may exactly balance the latter, or a weight muſt be appended to it juſt ſufficient to keep it *in equilibrio*, otherwiſe no accuracy can be be expected. This lever is the foundation of balances of all kinds, whether of the common kind or of that called the *Roman ſtatera* or ſteel-yard. The latter is no other than the lever repreſented in fig. 27. For if a ſcale is appended to the end A of the lever, and a weight, ſuppoſe of one pound, uſed as a counterpoiſe to the body which is to be put in the ſcale, it will ſhow exactly the weight of that body, by putting it at a proper diſtance from the fulcrum upon the long arm. Thus if the weight when placed at the diviſion 5 counterpoiſes that placed in the ſcale, it ſhows that the body weighs exactly five pounds: if it balances at 6, then it ſhows that the body weighs ſix pounds, &c. But for a more particular account of this inſtrument, ſee the article *Steel Yard*. To this kind of lever may be reduced ſeveral kinds of inſtruments, as ſciſſars, ſnuffers, pincers, &c.

15 Of the ſteel-yard,

In levers of this kind, the fulcrum C muſt ſupport both the weight to be raiſed and likewiſe that which raiſes it; ſo that the weight upon C muſt be the greater in proportion as the arm CB of the lever is ſhorter. Thus, if the arms are both equal, the fulcrum C muſt bear double the weight at A: if the one arm is double the length of the other, then it has only to bear the weight to be raiſed, and one half more; becauſe any weight at 2 will balance one double to itſelf at 1; but if removed to 10, the fulcrum will only have $1\frac{1}{10}$ to bear.

16 Second kind of lever,

In ſome caſes, the weight to be raiſed is placed between the acting power and the fulcrum, as in fig. 28. This lever is more powerful than the other, and is likewiſe more eaſily ſupported, becauſe only part of the weight to be raiſed, and none of that which raiſes it, lies upon the fulcrum. Thus in fig. 28. let the extremity A of the lever AB reſt upon a fulcrum at *o*, and let the ſmall weight 1, by means of a ſtring put over the wheel or pin C, pull up the other extremity; this weight 1 will then counterpoiſe the large one 10, and very little additional force will be required to raiſe it up. It is alſo plain, that the whole weight to be raiſed being 10, the fulcrum ſuſtains only 9 of it, for the other 1 is ſuſtained by the ſtring BC. It is plain alſo, that a lever of this kind only ten feet long will raiſe as great a weight as another of the former kind eleven feet in length; nevertheleſs there is not any abſolute gain of power, becauſe the ſmall weight 1 muſt move through ten times as much ſpace as the large one; and thus the quantity of motion is exactly equal in both. To this kind of lever we may reduce oars, doors turning upon hinges, cutting knives fixed at the point of the blade, &c. From it alſo we ſee the reaſon why two men carrying a burden upon a pole may bear unequal ſhares of the weight; for the nearer any one of them is to the burden, the greater ſhare he bears; and if he goes directly under it, he muſt bear the whole. Hence, if two perſons of unequal ſtrength are to carry a burden in this manner, the weaker ſhould always be placed at the greateſt diſtance from it.

17 Third kind of lever.

If in this lever the moving power be put in the place of the weight, it acts at a great diſadvantage; and a very great power will be requiſite to overcome a ſmall weight. The reaſon of this is plain from an inſpection of fig. 28; for it is the ſame thing whether we ſuppoſe the body 10 to be the moving power, or the weight to be raiſed; in either caſe, nine-tenths of it are ſpent upon the fulcrum at *o*; and the other tenth part at 10 will be able to do no more than balance the weight 1. Levers of this kind are only made uſe of when we wiſh to give a conſiderable degree of velocity to bodies: and hence the flys of clocks, millſtones, &c. may be accounted levers of this kind; for in theſe the moving power is applied to a pinion near the centre of motion, and acts at a great diſadvantage; the muſcles of the arms or legs of a man, by their inſertion near the joints, likewiſe act as levers of this kind; and hence the power exerted by a muſcle is always much greater than the force it has to overcome.

18 In what manner a power applied to a lever acts to the greateſt advantage Plate CCLXXXIV.

In all caſes in which the lever is applied, it is neceſſary, in order to give it the greateſt advantage, that the moving power act in a direction exactly perpendicular to the lever itſelf. If this be not the caſe, it will be neceſſary to lengthen the lever in proportion to the obliquity. Thus in fig. 29. ſuppoſe the ſtraight lever AB to reſt on the fulcrum C, ſo that a weight of one pound may counteract 10; if the lever be bent in the direction AD, it will then be neceſſary to lengthen it ſomewhat in order to produce the ſame effect. If bent in the direction CE, it muſt be farther lengthened, and ſtill farther if bent in the direction CF. The reaſon of this, is that when the weight acts on the bended lever ACF, ACE, and ACD, a part of its force is ſpent in giving, or attempting to give, a lateral motion to the fulcrum C; and the part thus loſt is exactly equal to the advantage gained by the greater length of the lever. To make a lever of a determinate length act always with the ſame power, it will be neceſſary to have ſome contrivance by which the moving power may act always perpendicularly to it; as by having two circular pieces of wood or other ſolid matter faſtened to the ends of it round which the ropes may wrap themſelves when it is put in motion, ſuch as are repreſented by *ab* and BG in the figure.

19 Fourth kind of lever.

Fig. 30. ſhows a kind of lever bent ſo that one part of it may form a right angle with the other. Here the prop or centre of motion is at the angular point C. P is a power acting upon the longer arm AC at F, by means of the cord DE going over the pulley G; and W is a weight of reſiſtance acting upon the end B of the ſhorter arm BC. If the power be to the weight as BC is to CF, they will remain in equilibrio. Thus ſuppoſe W to be five pounds acting at the diſtance of one foot from the centre of motion C, and P to be one pound acting at F five feet from the centre C, the power and weight will juſt balance each other. A hammer drawing a nail is a lever of this kind. In this lever the preſſure upon the fulcrum downwards is juſt equal to the weight to be raiſed; but there is likewiſe a lateral preſſure equal to the weight P; ſo that the centre of motion muſt have a double ſupport, otherwiſe the whole lever with the weight would be drawn towards the ſide in the direction BC.

20 Fifth kind of lever.

If, as in fig. 31. and 32. the lever be bent ſo as to form two ſides of a ſquare, the weight to be raiſed will always be equal to that upon the fulcrum, in whatever place the fulcrum may be put; but both will vary according to the diſtance from the angular point. Thus if as in fig. 31. the fulcrum be placed at the angular point A, the weight F appended to the extremity B

of

Fig. 13.

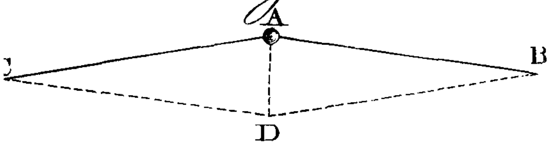


Fig. 14.

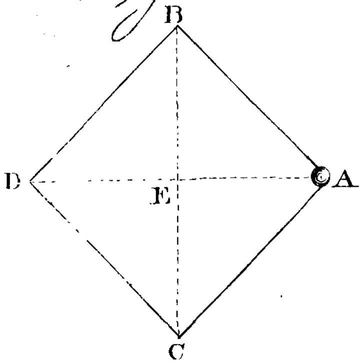
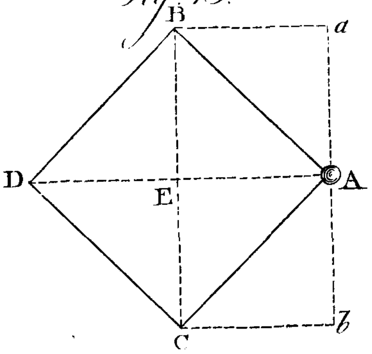


Fig. 15.



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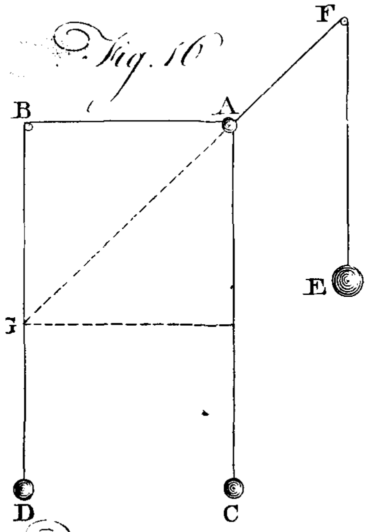
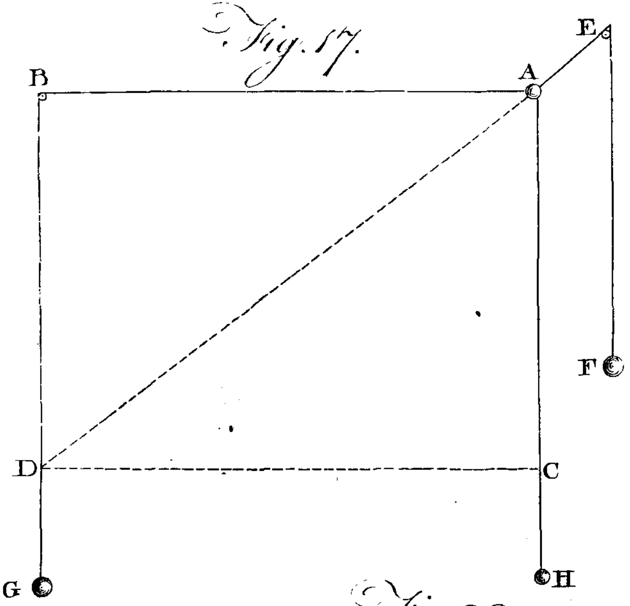


Fig. 17.



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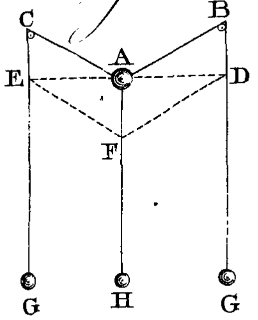


Fig. 18.

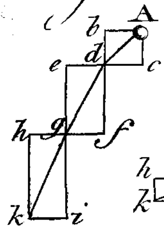
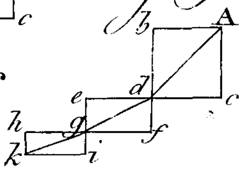


Fig. 19.



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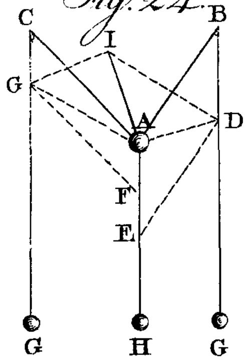

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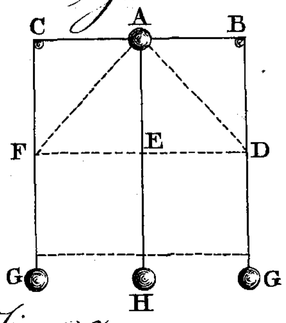


Fig. 21.

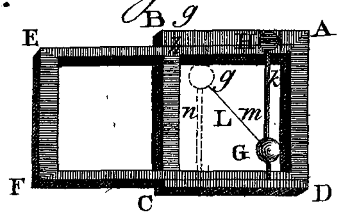


Fig. 20.

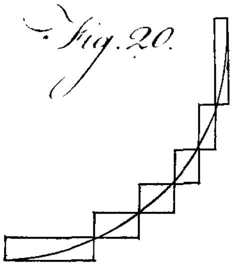


Fig. 25.

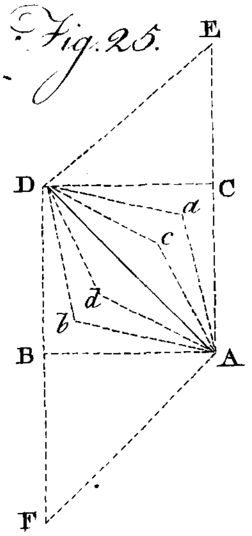


Fig. 26.

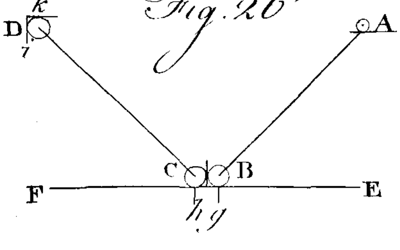


Fig. 27.

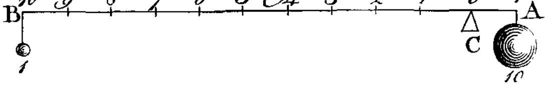
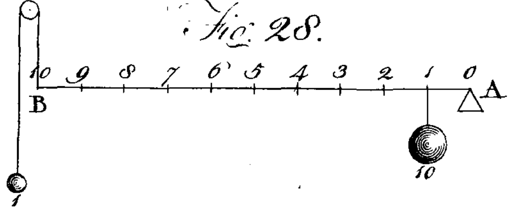


Fig. 28.



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of the arm AB will juſt counterpoiſe an equal weight E by means of the ſtring CDE put over the pin D, and drawn laterally by the arm AC. But if, as in fig. 32. the fulcrum be placed nearer to the extremity of the arm AC, as at 3, the caſe will then be very much altered, and one pound ſuſpended at the extremity B of the arm AB will counterpoiſe four at the extremity C of the other arm: the preſſure on the fulcrum will likewiſe be equal to the weight to be raiſed. Was the fulcrum placed at 2, then a weight of one pound at B would only counterpoiſe two pounds acting at C; and if it was placed at 1, then a weight of three pounds at B would be requiſite to counterpoiſe 4 at C.

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Levers of the fifth kind cannot be balanced by any other.

It is worth notice, that levers of this kind cannot be exactly counterpoiſed by the power of ſtraight levers. Thus in fig. 33 let any weight, as C, be appended to B, the extremity of the arm of the bent lever BA4. Let DE be a ſtraight lever, the force of which we deſign to oppoſe to that of the crooked lever. For this purpoſe let another weight F act upon the extremity D of this ſtraight lever by means of a ſtring put over the pin G. Let the two levers be connected together by means of the ſtring *h*3, and let a piece of wood or iron E4 be put between their two extremities; the two weights being now allowed to act, it is evident that the levers will be pulled in different directions, the ſtring *h*3 will be tightened, and the extremity E of the ſtraight lever DE will be preſſed towards 4, while the extremity 4 of the crooked lever will be preſſed towards E; by which means the two levers will oppoſe one another in every point of their action. There is not, however, any weight whatever applied to the ſtraight lever which can be made to counterbalance that at C, in ſuch a manner as to keep the bent lever ſteady. Let us firſt ſuppoſe the weights to be each one pound, and the ſtring to be placed as in the figure at *h*3. In this caſe the weight C pulls the crooked lever from *h* towards 3, with a force equal to 4, and the extremity 4 will be preſſed towards E with an equal degree of force. But in the ſtraight lever, though the point *h* be pulled in the direction 3*h* by a force of four pounds, the extremity E is preſſed the contrary way by a force equivalent only to three. Thus the weight C muſt preponderate, and that at F will aſcend. Let us next add to the weight F one third of a pound; by which means the preſſure from E towards 4 will be augmented to 4, and the two extremities of the levers will counteract each other: but now the preſſure in the direction 3*h* will be greater by one-third of a pound than it is in the direction *h*3: and of conſequence the weight F will prevail, the arm AB of the crooked lever and the weight appended to it being raiſed. If we attempt to mend matters by augmenting the weight F by not quite a third part, the extremities of the two levers will not balance each other, the preſſure from 4 to E will be greater than from E to 4; and in like manner the preſſure from 3 to *h* will be greater than from *h* to 3. Hence both levers will be pulled in a direction from D towards G, and the weight F will deſcend if the weights be properly adjuſted without any aſcent of the other. In ſhort, let us alter the weights as we will, or let us alter the poſition of the fulcrum as we will, it is eaſy to ſee that there is an abſolute impoſſibility that the two levers can counteract each other; becauſe the preſſure upon the fulcrum of the crooked lever will always be equal to that by its extremity 4; but in the ſtraight lever the preſſure upon the fulcrum muſt neceſſarily be greater than that of the extremity.

Theſe are all the varieties of the lever which can be ſuppoſed; it remains now only to ſhow the reaſon of its action, or why a ſmall weight when at reſt ſhould counterpoiſe a great one; motion or velocity being here to appearance out of the queſtion, as we cannot attribute any degree of motion to two bodies abſolutely at reſt. To do this in a clear and diſtinct manner has puzzled ſome of the greateſt mathematicians: that of Dr Hamilton profeſſor of philoſophy in Dublin, founded upon the reſolution of forces, ſeems to be the moſt readily underſtood, and leaſt liable to objection.

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Dr Hamilton's demonſtration of the properties of the lever.

‘ The moſt noted theorem in mechanics (ſays he) is this, “ When two heavy bodies counterpoiſe each other by means of any machine, and are then made to move together, the quantities of motion with which one deſcends and the other aſcends perpendicularly will be equal.” An equilibrium always accompanying this equality of motions bears ſuch a reſemblance to the caſe wherein two moving bodies ſtop each other when they meet together with equal quantities of motion, that many writers have thought that the cauſe of an equilibrium in the ſeveral machines might be immediately aſſigned, by ſaying, that ſince one body always loſes as much motion as it communicates to another, two heavy bodies counteracting each other muſt continue at reſt when they are ſo circumſtanced that one cannot deſcend without cauſing the other to aſcend at the ſame time, and with the ſame quantity of motion. For then, ſhould one of them begin to deſcend, it muſt inſtantly loſe its whole motion by communicating it to the other. This argument however plauſible it may ſeem, I think is by no means ſatisfactory; for when we ſay that one body communicates its motion to another, we muſt neceſſarily ſuppoſe the motion to exiſt firſt in the one, and then in the other; but in the preſent caſe, where the two bodies are ſo connected that one cannot poſſibly begin to move before the other, the deſcending body cannot be ſaid to communicate its motion to the other, and thereby make it aſcend: But whatever we ſhould ſuppoſe cauſes one body to deſcend, muſt be alſo the immediate cauſe of the other's aſcending: ſince from the connection of the bodies, it muſt act upon them both together as if they were really but one. And therefore, without contradicting the laws of motion, I might ſuppoſe the ſuperior weight of the heavier body, which is in itſelf more than able to ſuſtain the lighter, would overcome the lighter, and cauſe it to aſcend with the ſame quantity of motion with which the heavier deſcends; eſpecially as both their motions, taken together, may be leſs than what the difference of the weights, which is here ſuppoſed to be the moving force, would be able to produce in a body falling freely.

‘ However, as the theorom abovementioned is a very elegant one, it ought certainly to be taken notice of in every treatiſe of mechanics, and may ſerve as a very good index of an equilibrium in all machines: but I do not think that we can from thence, or from any one general principle, explain the nature and effects of all the mechanic powers in a ſatisfactory manner:

manner; becauſe ſome of theſe machines differ very much from others in their ſtructures, and the true reaſon of the efficacy of each of them is beſt derived from its particular ſtructure.

‘ The lever is conſidered as an inflexible line, void of weight, and moveable about a fixed point called its *fulcrum* or prop. The property of the lever, expreſſed in the moſt general term, is this: “ When two weights, or any two forces, act againſt each other on the arms of a lever, and are in equilibrio, they will be to each other inverſely as the perpendicular or ſhorteſt diſtances of their lines of direction from the fulcrum.”

‘ This propoſition contains two caſes; for the directions of the forces may either meet in a point, or be parallel to each other. Moſt writers begin their demonſtration of this propoſition with the ſecond caſe, which ſeems to be the ſimpleſt, and from which the other may be deduced by the reſolution of forces. Archimedes, in his demonſtration, ſets out with a ſuppoſition, the truth of which may reaſonably be doubted: for he ſuppoſes, that if a number of equal weights be ſuſpended from the arm of a lever, and at points equidiſtant from each other, whether all theſe points be at the ſame ſide of the fulcrum, or ſome of them on the oppoſite ſide, theſe weighs will have the ſame force to turn the lever as they would have were they all united and ſuſpended from a point which lies in the middle between all the points of ſuſpenſion, and may be conſidered as the common centre of gravity of all the ſeparate weights. Mr Huygens, in his *Miſcellaneous obſervations on mechanics*, ſays, that ſome mathematicians have endeavoured, by altering the form of this demonſtration, to render its defects leſs ſenſible; though without ſucceſs. He therefore propoſed another proof, which is extremely tedious and prolix, and alſo depends on a poſtulatum, that, I think, ought not to be granted on this occaſion; it is this; “ When two equal bodies are placed on the arms of a lever, that which is furtheſt from the fulcrum will prevail and raiſe the other up.” Now, this is taking it for granted, in other words, that a ſmall weight placed further from the fulcrum, will ſuſtain or raiſe a greater one. The cauſe and reaſon of which fact muſt be derived from the demonſtration that follows, and therefore this demonſtration ought not to be founded on the ſuppoſed ſelf-evidence of what is partly the thing to be proved.

‘ Sir Iſaac Newton's demonſtration of this propoſition is indeed very conciſe; but it depends on this ſuppoſition, that when from the fulcrum of a lever ſeveral arms or radii iſſue out in different directions, all lying in the ſame vertical plane, a given weight will have the ſame power to turn the lever from which-ever arm it hangs, provided the diſtance of its line of direction from the fulcrum remains the ſame. Now it muſt appear difficult to admit this ſuppoſition, when we conſider that the weight can exert its whole force to turn the lever only on that arm which is the ſhorteſt, and is parallel to the horizon, and on which it acts perpendicularly; and that the force which it exerts, or with which it acts perpendicularly, on any one of the oblique arms, muſt be inverſely as the length of that arm, which is evident from the reſolution of forces.

‘ Mr Maclaurin, in his *View of Newton's Philoſophy*, after giving us the methods by which Archimedes and Newton prove the property of the lever, propoſes one of his own, which, he ſays, appears to be the moſt natural one for this purpoſe. From equal bodies, ſuſtaining each other at equal diſtances from the fulcrum, he ſhows us how to infer that a body of one pound (for inſtance) will ſuſtain another of two pounds at half its diſtance from the fulcrum: and from thence that it will ſuſtain one of three pounds at a third part of its diſtance from the fulcrum; and going on thus, he deduces, by a kind of induction, what the proportion is in general between two bodies that ſuſtain each other on the arms of a lever. But this argument, were it otherwiſe ſatisfactory, yet as it cannot be applied when the arms of the lever are incommenſurable, it cannot conclude generally, and therefore is imperfect.

‘ There are ſome writers on mechanics, who, from the compoſition of forces, demonſtrate that caſe of the general propoſition relating to the lever in which the directions of the forces are oblique to each other, and meet in a point: but I do not find that they have had any other way of proving the ſecond caſe, in which the directions of the forces are parallel, but by conſidering theſe directions as making an angle with each other, though an infinitely ſmall one, or as meeting at an infinite diſtance: which way of reaſoning is not to be admitted in ſubjects of this kind, where the proof ſhould always ſhow us, directly from the laws of motion, why the concluſion muſt be true, in ſuch manner that we might ſee clearly the force of every ſtep from the firſt principles down to the concluſion, which we are prevented from doing when any ſuch arbitrary and inconſiſtent ſuppoſition is introduced.

‘ From thus conſidering the various proofs that have been given of this fundamental propoſition in mechanics, we may ſee the reaſon why many ſubſequent writers have appeared diſſatisfied with the former demonſtrations, and have looked for new ones: I ſhall now propoſe two methods of demonſtrating it, merely from the compoſition and reſolution of forces. The propoſition may be expreſſed as follows.

‘ When three forces act upon an inflexible line, whether ſtraight or crooked, and keep it in equilibrio, any two of them will be to each other inverſely as the perpendicular diſtances of their lines of direction from that point to which the third force is applied.”

‘ Let the three forces E, G, F, (fig. 34.) act upon three points A, B, D, in an inflexible line; and firſt let the directions of the forces E and F (which act on the ſame ſide of the line) meet in the point C. Then it is evident that the force, which is compounded of theſe two, muſt act upon the line ABD in the direction of a right line that paſſeth through the point C; conſequently the force G, which ſuſtains this compounded force, muſt be equal thereunto, and muſt act in a contrary direction; therefore the force G muſt act in the direction of the line C B. From the point B draw B H and B K perpendicular to the directions of the forces E and F, and draw B M and B N parallel to theſe directions, forming the parallelogram B M C N; then, ſince theſe three forces are in equilibrio, they muſt be to each other reſpectively as the ſides and diagonal of this parallelogram to which their directions are parallel; therefore E is to F as CM to CN or MB, that is, (becauſe the ſides of a triangle are as the ſines of the oppoſite angles) as the ſine of the angle MBC, or its alternate one BCN, to the ſine of the angle BCM; but making CB the radius, BK is the ſine of the former angle, and BH of the latter; therefore E is to F as BK to BH; ſo that the forces E and F are to each other inverſely as the perpendicular diſtances of their lines of direction from the point B, on which the third force G acts. Now to compare the forces F and G together: From the point A, on which the third force acts, draw AB and AL perpendicular to the directions of the forces G and F; then, as was ſaid before, F is to G as MB is to CB; but MB is to CB as AB to AL; becauſe, making CA the radius, AB is the ſine of the angle MCB, and AL is the ſine of the angle MCN, or CMB its ſupplement, to two right ones; therefore the forces F and G are to each other inverſely as the perpendicular diſtances of their lines of direction from the point A, on which the third force E acts; and thus the firſt caſe of the propoſition is proved, in which the forces act againſt each other in oblique directions.

‘We muſt now conſider what parts of the forces E and F act againſt the force G in directions parallel to GC; for it is ſuch parts only that really oppoſe the force G, and keep it in equilibrio; and from thence we ſhall ſee what proportion two forces muſt have to each other when they are in equilibrio, and act in parallel directions. Let the three forces act upon the points A, B, and D, (fig. 35.); let them be in equilibrio, and their lines of direction meet in the point C, as in the preceding caſe; then, if the points A, B, and D, are not in a right line, draw the line AD meeting BC in P, and from P draw PN and PM parallel to the directions of the forces E and F; through the points A and D draw parallel lines to BC; and through B draw a perpendicular to theſe lines, meeting them in H and K; from the point M draw MO parallel to AD, and meeting BC in O. Now the three forces E, G, and F, that are in equilibrio, will be to each other reſpectively as the ſides of the triangle CMP, as in the preceding caſe; but the force E, which is denoted by the line MC, may be reſolved into two forces acting in the directions MO and OC, the former of theſe only urges the point A towards D, and the latter acts in direct oppoſition to the force G; in like manner the force F, which is denoted by the line PM, may be reſolved into two forces acting in the directions OM and PO, the former of which only urges the point D towards A, and the latter acts in direct oppoſition to the force G; now it is evident that the force G, which is denoted by the line PC, is ſuſtained only by thoſe parts of the forces E and F which act againſt it, in directions parallel to BC, and are denoted by the lines OC and PO, which, taken together, are equal to PC; for the other parts of the forces E and F, which are denoted by MO, are loſt, being equal, and contrary to each other: if, therefore, inſtead of the forces F and E, we ſuppoſe two other forces, R and L, to act on the points D and A, in directions parallel to BC, and to keep the force G in equilibrio, it follows, from what has been proved, that R and L taken together will be equal to G, and that theſe three forces will be to each other reſpectively as the lines PO, OC, and PC; therefore R will be to L as PO to OC, (that is, as AM to MC, or as AP to PD, or) HB to BK; conſequently the forces R and L are to each other inverſely as the perpendicular diſtances of their lines of direction from the point B, to which the third force is applied. Now to compare the forces R and G together; ſince the forces R and L may be denoted by BH and BK, and are both together equal to G, that force will be denoted by the whole line KH, and therefore R will be to G as BH to KH; ſo that theſe forces are alſo to each other inverſely as the perpendicular diſtances of their lines of direction from the line of direction of the third force L; and thus the ſecond caſe of the propoſition is proved, in which the forces act againſt each other in parallel directions. If the point in the inflexible line, to which one of the forces is applied, ſhould become a fixed point, or *fulcrum*, round which the line may turn, it is evident that the other two forces will continue in equilibrio, as they were before; and therefore the property of the lever, in all caſes, is manifeſtly proved by this propoſition.

‘The centre of gravity of a body is ſaid to be that point which being ſuſtained, or prevented from deſcending, the body will continue at reſt. From hence it follows, that when a body hangs freely from a ſingle point and continues at reſt, its centre of gravity will lie perpendicularly under the point of ſuſpenſion; for in that ſituation only it will be ſuſtained, and can deſcend no lower.

‘From this property, which agrees likewiſe to the common centre of gravity of two bodies joined together by an inflexible right line, and which may then be conſidered as one, I ſhall ſhow that their centre of gravity is a point in the line that joins them together, ſo ſituated that the diſtances of the two bodies from it are to each other inverſely as their weights. This theorem concerning the poſition of the common centre of gravity of two bodies, which is a very noted one in mechanics, I have never ſeen demonſtrated otherwiſe than by inferring it from the general property of the lever: but I think the method I ſhall now propoſe of deducing it directly from the definition of the centre of gravity, is the moſt conciſe as well as the moſt natural, and beſides it will afford us a very eaſy way of demonſtrating the property of the lever.

‘Let the two bodies A and B (fig. 36.) be joined by an inflexible right line paſſing through their centres of gravity, and let them be ſuſpended from the fixed point or pin at P, by the threads AP and BP, ſo that they may hang freely in ſuch a poſition as their joint gravity will give them. When theſe bodies continue at reſt, their common centre of gravity muſt lie directly under the point of ſuſpenſion, or in the perpendicular line PL, conſequently it muſt be at the point C, the interſection of the lines PL and AB; the poſition of which point, in the line AB, will be determined by finding out the proportion between the ſegments CA and CB. If the inflexible line was not interpoſed between theſe bodies, they would move till their threads coincided with the perpendicular line PL; ſince therefore they are kept aſunder by this line, they muſt urge it with certain forces in oppoſite directions; and theſe urging forces muſt be equal, ſince the line on which they act continues at reſt: and therefore the force with which each body urges the other in the direction of this line, may be denoted by the ſame letter U, and we may denote the weights of the two bodies reſpectively by the letters A and B. Now the body A is acted upon by three forces, viz. by its weight A in the direction PC, by the force U with which the other body urges it in the direction CA, and by the reaction of the pin in the direction AP; and ſince theſe three forces are in equilibrio, and keep the body at reſt, they are to each other reſpectively as the ſides of the triangle PCA; therefore A is to U, as PC to CA. In like manner, the body B is urged by three forces, *viz.* its weight B in the direction PC, the urging force U in the direction CB, and the reaction of the pin in the direction BP, which forces are to each other as the ſides of the triangle PCB; therefore U is to B, as CB to PC; and therefore (*ex æquo perturbate*) A is to B, as CB to CA; conſequently the weights of the bodies A and B are to each other directly as their diſtances from the point C, which lies directly under the point of ſuſpenſion, and is therefore their common centre of gravity.

‘When two bodies are connected by an inflexible line, and this line is ſupported by a prop ſo that their centre of gravity cannot deſcend, the bodies muſt continue to reſt, and will be in equilibrio. Therefore it is eaſy to ſee how, from the theorem now demonſtrated, we may prove the property of the lever in that caſe where the directions of the forces are parallel; and from thence the other caſe, in which the directions are oblique to each other, may be deduced by the reſolution of forces, as is uſually done. And this is the ſecond method by which I ſaid the general property of the lever might be ſtrictly demonſtrated.

‘The lever is the moſt ſimple of all the mechanic powers; and to it may be reduced the balance and the *axis in peritrochio*, or axle and wheel: Though I do not conſider the balance as a diſtinct mechanic power, becauſe it is evidently no other than a lever fitted for the particular purpoſe of comparing the weights of bodies, and does not ſerve for raiſing great weights or overcoming reſiſtances as the other machines do.’

23 Another demonſtration.

Though this demonſtration will no doubt be abundantly clear to mathematical readers, yet to others leſs verſed in that ſcience its appearance will no doubt be ſomewhat obſcure and perplexed. The following we ſubjoin as leſs intricate.

Let AB, fig. 37, repreſent a ſtraight rod of wood or iron, faſtened at the extremity A, at right angles to another piece of the ſame, and kept ſteady by two pins C and D. If a weight be put upon the extremity H of the upright rod AH, it will preſs down that, and along with it the horizontal rod AB, ſo that every point in the rod will move with the whole force of the weight. Thus, whether we ſuppoſe an obſtacle to be placed at the extremity B, at the point 2, or at 1, in the horizontal rod AB, it will have exactly the force of the weight placed at H to overcome.—Suppoſing then that the weight would make the whole deſcend from A to E in one ſecond; then it is plain that the whole power exerted by the rod in its deſcent would be expreſſed by the parallelogram ABEF. But if, inſtead of ſuppoſing the line AB to be the full length repreſented in the figure, we ſuppoſe it to be only half that length, and cut off at 1, then the power of the weight would be repreſented by the parallelogram A 1 E 1. Were it ſtill farther ſhortened by being cut off at 2, then the power would be repreſented by the parallelogram A 2 E 2; and each of theſe parallelograms, however unequal they may be as repreſented upon paper, would in reality be equal when the experiment was made, becauſe in no caſe could the weight deſcend with a greater force than its own. Suppoſe next the weight to be taken off from H, and put upon B, and the rod AB to be moveable upon the centre A; the whole power of the weight then would be expreſſed by the triangle ABG, equal to the parallelogram ABEF; but as every point of the lever muſt bear the whole impulſe of the weight as before, it is plain, that as we approach towards the centre, that power is compreſſed into leſs and leſs ſpace. Thus, when the weight has deſcended from B to G, though the large triangle ABG be equal to the parallelogram ABEF, yet the ſmaller triangle A 1 1 is equal only to one half of the parallelogram A 1 E 1, which repreſents the power. The whole power being therefore compreſſed into half the ſpace, muſt of neceſſity be double to what it was in the former caſe. In like manner, the triangle A 2 *b*, is only equal to one half of the parallelogram A 2 *a b*; and this parallelogram itſelf is only half the ſpace repreſenting the whole power of the weight. In this caſe, therefore, the power is confined within one fourth part of the ſpace which it naturally has, and for that reaſon muſt be four times as great.

§ 2. *Of the Wheel and Axle, or Axis in Peritrochio.*

THIS power acts entirely on the principles of the lever, and has therefore ſometimes been called a perpetual lever. In it the power is applied to the circumference of a wheel by means of a rope or otherwiſe, the weight to be raiſed being faſtened to a rope which winds round the axis. It is repreſented fig. 38, where AB is the wheel, EDF its axis, P the moving power, and W the weight to be raiſed by means of the rope K coiling itſelf about the axis. It is plain then from an inſpection of the figure, that when the large wheel has made one revolution, the weight P will have deſcended through a ſpace equal to the circumference, and as much of the cord I, by which it is ſuſpended, will be wound off. On the other hand, the weight W will have aſcended only through a ſpace equal to the circumference of the axle, and juſt ſo much of the rope K will be wound up upon it. As the circumference of the wheel, therefore, is to that of the axis, ſo will the velocity of the moving power be to that of the weight to be raiſed, and of conſequence ſuch will be the force of the machine: thus, if the circumference of the wheel be eight, ten, twelve, or any number of times as large as that of the axle, one pound applied to the circumference will counterbalance eight, ten, twelve, or more pounds, applied to the axle, and a ſmall addition will raiſe it up.

24 Of the engines called cranes.

The engines called *cranes*, for raiſing great weights, are no other than wheels of this kind. Sometimes they are moved by handles S, S, &c. placed on the circumference of the wheel, which is turned by mens hands, as is ſhown fig. 38. Sometimes the wheel is hollow, and

furniſhed

furniſhed with ſteps, on which a man, who is incloſed in the wheel, continually ſteps his feet, as if he was aſcending a ſtair; and thus the wheel yielding to his weight turns round, and coils up the rope which raiſes the weight about its axis. When the crane is to be turned by mens hands, it may advantageouſly have cogs all round the circumference, in which a ſmall trundle may be made to work and be turned by a winch.—Thus the power of the man who works it will be greatly increaſed; for his ſtrength will be augmented as many times as the number of revolutions of the winch exceeds that of the axle D, when multiplied by the exceſs of the length of the winch above the length of the ſemidiameter of the axle, added to the ſemidiameter or half the thickneſs of the rope K, by which the weight is drawn up. Thus, ſuppoſe the diameter of the rope and axle taken together to be 12 inches, and conſequently half their diameters to be 6 inches, ſo that the weight W will hang at ſix inches perpendicular diſtance from below the centre of the axle; let us ſuppoſe the wheel A B, which is fixed on the axle, to have 80 cogs, and to be turned by means of a winch ſix inches long, fixed on the axis of a trundle of eight ſtaves or rounds, working in the cogs of the wheel. Here it is plain that the winch and trundle would make ten revolutions for one of the wheel A B, and its axis D, on which the rope K winds in raiſing the weight W: and the winch being no longer than the ſum of the ſemidiameters of the great axle and rope, the trundle could have no more power on the wheel than a man could have by pulling it round by the edge, becauſe the winch would then have no greater velocity than the edge of the wheel has, which is ſuppoſed to be ten times the velocity of the riſing weight; ſo that in this caſe the acquiſition of power would be as 10 to 1. But if the length of the winch be 12 inches, the power gained will be as 20 to 1; if 18 inches, which is a ſufficient length for any man to work with, the acquiſition of power will be as 30 to 1; becauſe the velocity of the handle would be 30 times as great as that of the riſing weight, and the abſolute force of any machine is exactly in proportion to the velocity of the weight raiſed by it. We muſt always remember, however, that juſt as much time is loſt in working the machine as there is power gained by it; for none of the mechanical powers are capable of gaining both power and velocity at the ſame time.

In all cranes, it is neceſſary to have a racked wheel, repreſented by G, on one end of the axle, with a catch H to fall into its teeth; which will at any time ſupport the weight, and keep it from deſcending, if the workman ſhould happen to let ſlip his hold. For want of this precaution, terrible accidents have ſometimes happened to people incloſed in cranes, by their inadvertently miſſing a ſtep.

§ 3. *Of the Pulley.*

The pulley is a ſingle wheel of wood, braſs, or iron, moveable upon an axis, and incloſed in a kind of caſe called its *block*, which admits of a rope to paſs freely over the circumference of the pulley, in which alſo there is uſually a groove to keep the rope from ſliding, the axis being generally fixed in the block. In ſome pulleys the block is fixed; in others moveable, and riſes with the weight. Both theſe kinds are repreſented, fig. 39. AA ſhows a fixed pulley, with its block *b*. Over the wheel a ſtring BB paſſes, to the extremities of which are fixed the two weights W and P. This pulley, however, though it changes the direction of a power, yet does not gain any advantage; for one of the weights muſt always deſcend as much as the other aſcends, of conſequence their velocities muſt always be equal; and when this is the caſe, there can be neither increaſe nor decreaſe of power. A ſingle fixed pulley, therefore, though it may compare the weight of two bodies together, cannot be accounted in any reſpect a mechanical power. But if with a fixed pulley we combine a moveable one, or one in which the block ariſes along with the wheel, we gain an increaſe of one half. Thus if a weight W hangs at the lower end of the moveable block P of the pulley D, and the cord G F goes under the wheel, it is plain that the half G of the cord bears one half of the weight W, and the half F the other. The hook H, therefore, which ſuſtains the half G of the cord, muſt therefore bear one half of the weight; and if the cord at F be drawn up, ſo that the pulley may be raiſed from D to C, the ſtring will be extended to its whole length, all but that which goes under the wheel of the pulley D; but the weight or power P by which the ſtring is thus drawn up, will have moved twice as far as the weight W which is drawn up: whence we ſee that only one pound at P will be requiſite to counterpoiſe two pounds at W. If the upper and fixed block contain two pulleys, and the lower one U contain alſo two, the advantage gained by this combination will be as 4 to 1. Thus, if one end of the ſtring KMOQ be fixed to a hook at I, and the ſtring paſſes over the pulleys N and R, and under thoſe L and P, the weight T of one pound will balance a weight W of four pounds, ſuſpended by a hook from the moveable block, making allowance for the weight of the block itſelf. In like manner will the pulleys give an advantage of 4 to 1, when diſpoſed as at X and Y; but in all caſes the ſame relation between velocity and power is preſerved as in the lever and axis in peritrochio, viz. if the power balances twice its own weight, it muſt move or have a tendency to move through twice the ſpace; if it balances four times its weight, then it muſt have a tendency to move through four times the ſpace that the other does.

25
Advantages and diſadvantages of pulleys.

Pulleys are of great uſe in practical mechanics, as by their means great weights may be raiſed to any height much more expeditiouſly than by any other method, and the ſmallneſs of their weight makes them very convenient for carriage. At ſea they are uſed for hoiſting the ſails and yards, ſtraitening ropes, &c. Archimedes, by means of a machine compoſed of pulleys, is ſaid to have drawn a ſhip along the ſtrand, in the preſence of Hiero king of Syracuſe; but this is ſcarcely to be credited, on account of the great friction which attends this kind of machines.—The friction ariſes from three cauſes: 1. The diameter of the axis bearing a conſiderable proportion to that of the wheels. 2. Their rubbing againſt their blocks, or againſt one another. 3. The ſtiffneſs of the rope that goes over and under them. All theſe cauſes muſt neceſſarily be augmented, in proportion to the weight we have to overcome; and when we conſider the immenſe reſiſtance which a ſhip muſt make, with the ſtrength and ſtiffneſs of the ropes neceſſary to overcome it, we can ſcarce ſuppoſe the ſtrength of any individual equal to the taſk. Pulleys have often been uſed by inhuman tyrants, in conſtructing machines for torturing the objects of their cruelty.

26 Reaſon of the effects of the pulley.

The pulley has by ſome writers been reduced to the lever as well as the wheel and axis; in which method they conſider the fixed pulleys as a lever of the firſt, and the moveable pulley as one of the ſecond kind: but it is juſtly obſerved by Profeſſor Hamilton, that the pulley cannot be with any propriety reduced to a lever; becauſe, though both the moveable and immoveable pulleys ſhould be taken away, the ropes would have to ſuſtain the ſame weight that they do with the pulleys; nay, the very ſame advantages would be gained by the mere uſe of pins, without any wheels, were not the friction very great even upon the ſmootheſt pins that could be made uſe of. It is, indeed, merely to avoid this reſiſtance on the pins that wheels are made uſe of at all. The beſt method of computing the power, and explaining the reaſon of the effects of pulleys, is by conſidering that every moveable pulley hangs by two ropes equally ſtretched, each of which bears one half of the weight; and therefore, when the ſame rope goes round a number of fixed and moveable pulleys, ſince all its parts on each ſide of the pulleys are equally ſtretched, the whole weight muſt be equally divided amongſt all the ropes by which the moveable pulleys hang; conſequently, if the power which acts on one rope be equal to the weight divided by the number of ropes, that power will ſuſtain the weight.

27 Mr White's patent pulley. Plate cclxxxvii.

A very conſiderable improvement in the conſtruction of pulleys has been made by Mr James White, who has obtained a patent for his invention, and of which the following deſcription is given by the inventor. Fig. 68 ſhows the machine, conſiſting of two pulleys Q and R, one fixed and the other moveable. Each of theſe has ſix concentric grooves, capable of having a line put round them, and thus acting like as many different pulleys, having diameters equal to thoſe of the grooves. Suppoſing then each of the grooves to be a diſtinſt pulley, and that all their diameters were equal, it is evident that if the weight 144 were to be raiſed by pulling at S till the pulleys touched each other, the firſt pulley muſt receive that length of line as many times as there are parts of the line hanging between it and the lower pulley. In the preſent caſe, there are 12 lines, b, d, f, &c. hanging between the two pulleys, formed by its revolution about the ſix upper and ſix lower grooves. Hence as much line muſt paſs over the uppermoſt pulley as is equal to twelve times the diſtance of the two. But, from an inſpection of the figure, it is plain, that the ſecond pulley cannot receive the full quantity of line by as much as is equal to the diſtance betwixt it and the firſt. In like manner, the third pulley receives leſs than the firſt by as much as is the diſtance between the firſt and third; and ſo on to the laſt, which receives only one twelfth of the whole. For this receive its ſhare of line *n* from a fixed point in the upper frame, which gives it nothing; while all the others in the ſame frame receive the line partly by turning to meet it, and partly by the line coming to meet them.

Suppoſing now theſe pulleys to be equal in ſize, and to move freely as the line determines them, it appears evident, from the nature of the ſyſtem, that the number of their revolutions, and conſequently their velocities, muſt be in proportion to the number of ſuſpending parts that are between the fixed point abovementioned and each pulley reſpectively. Thus the outermoſt pulley would go twelve times round in the time that the pulley under which the part *n* of the line, if equal to it, would revolve only once; and the intermediate times and velocities would be a ſeries of arithmetical proportionals, of which, if the firſt number were 1, the laſt would always be equal to the whole number of terms. Since then the revolutions of equal and diſtinct pulleys are meaſured by their velocities, and that it is poſſible to find any proportion of velocity on a ſingle body running on a centre, viz. by finding proportionate diſtances from that centre, it follows, that if the diameters of certain grooves in the ſame ſubſtance be exactly adapted to the above ſeries (the line itſelf being ſuppoſed inelaſtic, and of no magnitude), the neceſſity of uſing ſeveral pulleys in each frame will be obviated, and with that ſome of the inconveniences to which the uſe of the pulley is liable.

In the figure referred to, the coils of rope by which the weight is ſupported are repreſented by the lines *a*, *b*, *c*, &c.; *a* is the *line of fraction*, commonly called the fall, which paſſes over and under the proper grooves, until it is faſtened to the upper frame juſt above *n*. In practice, however, the grooves are not arithmetical proportionals, nor can they be ſo; for the diameter of the rope employed muſt in all caſes be deducted from each term; without which the ſmaller grooves, to which the ſaid diameter bears a larger proportion than to the larger ones, will tend to riſe and fall faſter than they, and thus introduce worſe defects than thoſe which they were intended to obviate.

The principal advantage of this kind of pulley is, that it deſtroys lateral friction, and that kind of ſhaking motion which are ſo inconvenient in the common pulley. "And leſt (ſays Mr White) this circumſtance ſhould give the idea of weakneſs, I would obſerve, that to have pins for the pulleys to run on, is not the only nor perhaps the beſt method; but that I ſometimes uſe centres fixed to the pulleys, and revolving on a very ſhort bearing in the ſide of the frame, by which ſtrength is increaſed, and friction very much diminiſhed; for to the laſt moment the motion of the pulley is perfectly circular: and this very circumſtance is the cauſe of its not wearing out in the centre as ſoon as it would, aſſiſted by the ever increaſing irregularities of a gullied bearing. Theſe pulleys, when well executed, apply to jacks and other machines of that nature with peculiar advantage, both as to the time of going and their own durability; and it is poſſible to produce a ſyſtem of pulleys of this kind of ſix or eight parts only, and adapted to the pockets, which, by means of a ſkain of ſewing ſilk, or a clue of common thread, will raiſe upwards of an hundred weight.

§ 4. *Of the Inclined Plane.*

Plate CCLXXXIV.

THIS power is repreſented fig. 40 ; and the advantage gained by it is exactly in the proportion of the length of the plane to the perpendicular height of it. Thus, let AB be a plane parallel to the horizon, and CD one inclined to it : ſuppoſe alſo the whole length CD to be three times as great as the perpendicular height G*f*F ; in this caſe, the cylinder E will be ſupported upon the plane CD, and kept from rolling down upon it, by one-third part of its weight. Were the length of the plane four times its height, it would be prevented from rolling down by one-fourth part of its weight. The force with which a rolling body deſcends upon an inclined plane will be to that with which it would deſcend by the power of gravity, as the height of the plane is to the length of it.—For, ſuppoſe the plane AB (fig. 41.) to be parallel to the horizon, the cylinder C will keep at reſt upon any part of the plane on which it is laid. If the place be ſo elevated as in fig. 42, that its perpendicular height D be equal to one half of its length AB, then the cylinder will roll down with half its weight; for it would require a power (acting in the direction AB) equal to half its weight to keep it from rolling. If the plane be elevated ſo as to be perpendicular to the horizon, as in fig. 43. the cylinder C will deſcend with its whole force of gravity, becauſe the plane contributes nothing to the ſupport or hinderance of it ; for which reaſon, it muſt require a power equal to the whole force of its gravity to keep it from deſcending.

If, as in fig. 44. the cylinder C be made to turn upon ſlender pivots in the frame D, which is furniſhed with a hook, with a line G faſtened to it ; if this line go over the fixed pulley H, and have its other end tied to the hook in the weight I ; if the weight of the body I be to the weight of the cylinder C, added to that of its frame D, as the perpendicular height of the plane LM is to its length AB ; the weight will juſt ſupport the cylinder, and a ſmall force will make it either aſcend or deſcend. In the time that the cylinder moves from A to B, it muſt riſe through the whole height of the plane ML, and the weight will deſcend from H to K, through a ſpace equal to the whole length of the plane AB. If the plane be now made to move upon rollers or wheels as in fig. 45. and the cylinder be ſupported upon it, the ſame power will draw the cylinder up the plane, provided the pivots of the wheels be ſmall, and the wheels themſelves pretty large. For let the machine ABC, equal in height and length to ABM, fig. 44. be furniſhed with four wheels, of which two are ſeen at D and E, the third being under C, while the fourth is concealed by the board *a*. Let the cylinder F be laid upon the lower end of the inclined plane CB, and the line G be extended from the frame of the cylinder about ſix feet, parallel to the plane CB, and fixed in that direction to a hook in the wall, which will keep the cylinder from rolling off the plane. Let one end of the line H be tied to a hook at C in the machine, and the other to a weight K, the ſame which drew the cylinder up the plane before. If this line be put over the fixed pulley I, the weight K will draw the machine along the horizontal plane L, and under the cylinder F ; and when the machine has been drawn the whole length CB, the cylinder will be raiſed to *d*, equal to the perpendicular height AB above the horizontal part at A.

28 Reaſon of the effects of the inclined plane.

The inclined plane, conſidered as a mechanical power, may eaſily be reduced to the lever ; for the power acquired by it is always in the proportion of the length to the height, in the ſame manner as the power acquired by a lever is in the proportion of the long arm to the ſhort one. To compute, or ſhow the reaſon of the power of an inclined plane, therefore, we have only to conſtruct a lever, the long arm of which is equal to the length of the plane, and the ſhort arm to the height of it ; then, whatever weight put upon the long arm counterpoiſes another put upon the ſhort one, will alſo keep the ſame weight from rolling down the inclined plane.

To the inclined plane belong alſo the wedge, and all cutting inſtruments which as wedges, as knives, hatchets, &c. From the theory of the inclined plane alſo combined with that of falling bodies, we deduce ſome of the moſt remarkable properties of the pendulum. See PENDULUM.

§ 5. *Of the Wedge.*

Plate CCLXXXV.

THIS may be conſidered as two equally inclined planes DEF and CEF, fig. 46. joined together at their baſes e EFO : DC is the whole thickneſs of the wedge at its back ABCD, where the power is applied ; EF is the depth or height of the wedge ; DF the length of one of its ſides, equal to CF the length of the other ſide ; and OF is its ſharp edge, which is entered into the wood or other matter to be ſplit, by the force of a hammer or mallet ſtriking perpendicularly upon its back. Thus AB, fig. 47. is a wedge driven into the cleft CED of the wood FG.

When the wood does not cleave at any diſtance before the wedge, there will be an equilibrium between the power impelling the wedge downward, and the reſiſtance of the wood acting againſt the two ſides of the wedge : if the power be to the reſiſtance as half the thickneſs of the wedge at its back is to either of its ſides, and if the power be increaſed ſo as to overcome the friction of the wedge, and the reſiſtance ariſing from the coheſion of the wood, the wedge will be driven in, and the wood ſplit. But when the wood ſplits, as it commonly does, before the wedge, the power impelling the latter will not be to the reſiſtance of the wood as half the thickneſs of the wedge is to one of its ſides, but as half its thickneſs is to the length of the other ſide of the cleft, eſtimated from the top or acting part of the wedge ; for if we ſuppoſe the wedge to be lengthened down to the bottom of the cleft at E, the ſame proportion will hold ; namely, that the power will be to the reſiſtance, as half the thickneſs of the wedge is to the length of either of its ſides ; or, which is the ſame thing, as the whole thickneſs of the wedge is to the length of both its ſides.

To prove this, let us ſuppoſe the wedge is divided lengthwiſe into two equal parts ; in which caſe, it will become two equally inclined planes, one of which, as *abc* fig. 48. may be made uſe of for ſeparating the moulding *cd* from the wainſcot AB. It is evident, that when this half wedge has been driven its whole length *ac* between the wainſcot and mouldings, its inſide *ac* will be at *cd*, and the moulding will be ſeparated to *fg* from the wainſcot. But, from what has been already ſhown concerning the inclined plane, it appears, that, to have an equilibrium between the power impelling the half wedge and the reſiſtance of the moulding, the former muſt be to the latter as *ab* to *ac*, that is, as the thickneſs of the back which receives the ſtroke is to the length of the ſide againſt which the moulding acts. Since, therefore, the power upon the half wedge is to the reſiſtance againſt its ſide as the half back *ab* is to the whole ſide *ac*, it is plain that the power upon the whole wedge, where the whole thickneſs is double the half-back, muſt be to the reſiſtance of both its ſides as the thickneſs of the whole back is to the length of both ſides of the cleft, when the wood ſplits at any diſtance before the wedge: For when the wedge is driven quite into the wood, and the latter ſplits at ever ſo ſmall a diſtance before it, the top of the wedge then becomes the acting part, becauſe the wood does not touch it any where elſe. And ſince the bottom of the cleft muſt be conſidered as the place where the whole reſiſtance is accumulated, it is plain from the nature of the lever, that the farther the power is from the reſiſtance, the greater advantage it acts with.

29
Reaſon of the effects of the wedge.

Some have ſuppoſed, that the power of the wedge was in the proportion of the thickneſs of it to the length of one of its ſides; but from what has already been advanced, it is plain that this cannot be the caſe. The wedge, as has already been ſhown, is compoſed of two inclined planes, each of which has a perpendicular height of only one half the thickneſs of the wedge. As the power of the inclined plane therefore is always as the length to its perpendicular height, it is evident that the power of each of theſe inclined planes of which the wedge is compoſed muſt be as the length of one ſide to half the thickneſs; and conſequently the power of both muſt be as the length of both ſides is to the whole thickneſs.

The power of the wedge is exceedingly great, inſomuch that not only wood but rocks may be ſplit by it, which could ſcarce be done by any of the other powers; but in this it is aſſiſted by percuſſion of the hammer which drives it, and ſhatters the ſtone in a manner that could ſcarcely be done by any ſimple preſſure.—Wedges as well as pulleys have alſo been uſed as inſtruments of torture.

§ 6. *Of the Screw.*

This is the ſtrongeſt of all the mechanical powers, though it cannot be accounted a ſimple one, as no ſcrew can be made uſe of without a lever or winch to aſſiſt in turning it. We may ſuppoſe it made by cutting a piece of paper into the form of an inclined plane or half wedge, and then wrapping it round a cylinder, as in fig. 49. From this figure it is evident, that the winch which turns the cylinder muſt move once round in the time that the paper deſcribes one ſpiral; and conſequently if any weight or greater power of reſiſtance were applied, the winch muſt turn once round in the time that the weight would move from one ſpiral thread to another, from d to c for inſtance. Hence the force of the ſcrew will be as the circumference of the circle defined, by the lever or winch by which it is turned, is to the diſtance between the threads of the ſcrew itſelf. Thus, ſuppoſing the diſtance of the threads to be half an inch, and the length of the winch twelve inches, the circle deſcribed by the extremity of it where the power acts will be nearly 76 inches, or about 152 times the diſtance between the threads; whence a ſingle pound acting at the end of ſuch a winch would balance 152 at the extremity of the ſcrew; and as much more as can overcome the friction would turn the winch and raiſe up the weight.

30
Machine for exhibiting the force of the ſcrew.

Fig. 50. repreſents a machine for exhibiting the force of the ſcrew, Let the wheel C have upon its axis a ſcrew *ab*, working in the teeth of the wheel D, which ſuppoſe to be 48 in number. It is plain that every time the ſcrew *ab* and wheel C are turned round by the winch A, the wheel D will be moved one tooth by the ſcrew; and therefore in 48 revolutions of the winch, the wheel D will be turned once round. If then the circumference of a circle deſcribed by the handle of the winch A be equal to the circumference of a groove *e* round the wheel D, the velocity of the handle will be 48 times as great as the velocity of any given point in the groove. Conſequently if the line G goes round the groove *e*, and has a weight of 48 pounds hung to it below the pedeſtal EF, a power of one pound at the handle will balance that weight. If the line G goes round the axle I inſtead of the groove of the wheel D, the force of the machine will be as much increaſed as the circumference of the groove *e* is greater than that of the axle; which, ſuppoſing to be ſix times, then one pound at H will balance 288 pounds ſuſpended by the line at the axle.

The ſcrew is of very extenſive uſe in mechanics, its great power rendering it more eligible for compreſſing bodies together than any of the reſt, and the great diſparity betwixt the velocity of the handle and that of the threads of the ſcrew, rendering it proper for dividing ſpace into an almoſt infinite number of parts. Hence, in the conſtruction of many mathematical inſtruments, ſuch as teleſcopes, where it is neceſſary to adjuſt the focus to the eyes of different people, the ſcrew is always made uſe of in order to move the eye-glaſs a very little nearer or farther away from the object glaſs. In the 71ſt volume of the Philoſophical Tranſactions, a new method of applying the ſcrew, ſo as to make it act with the greateſt accuracy, is deſcribed by Mr Hunter ſurgeon. The following are the general principles upon which this method depends.

31
Mr Hunter's improvement on the ſcrew.

1. That the ſtrength of the ſeveral parts of the engine be adjuſted in ſuch a manner to the force they are intended to exert, that they ſhall not break under the weight they ought to counteract, nor yet encumber the motion by a greater quantity of matter than is neceſſary to give them a proper degree of ſtrength.

2. That the increaſe of power by means of the machine be ſo regulated, that while the force we can exert is thereby rendered adequate to the effect, it may not be retarded in procuring it more than is abſolutely neceſſary.

3. That the machine be as ſimple as is conſiſtent with other conditions.

4. It ought to be as portable, and as little troubleſome as poſſible in the application.

5. The moving power muſt be applied in ſuch a manner as to act to the greateſt advantage; and that the

Fig. 29.

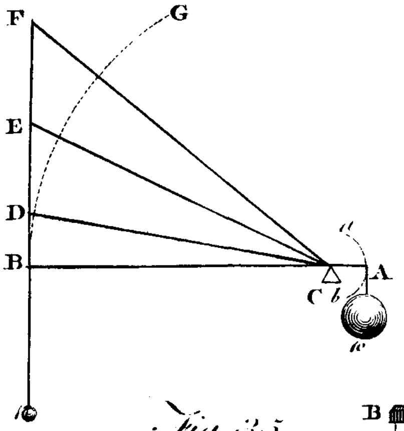


Fig. 30.

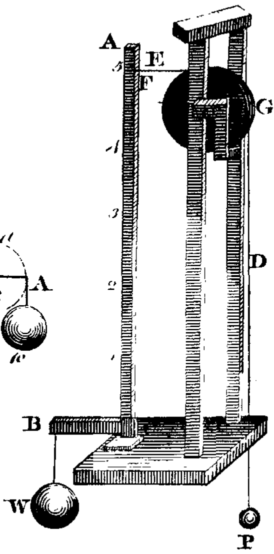


Fig. 31.

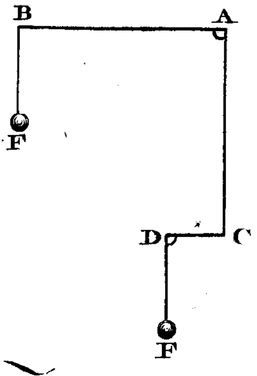


Fig 34

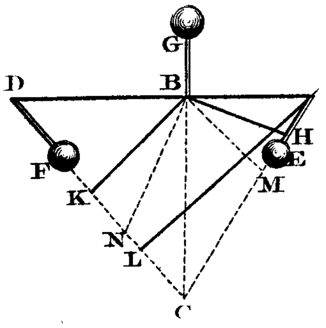


Fig. 32.

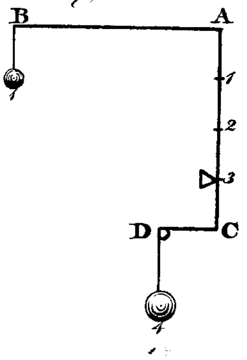


Fig. 33.

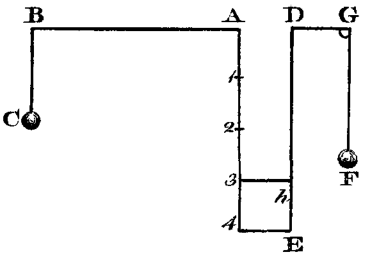


Fig. 35.

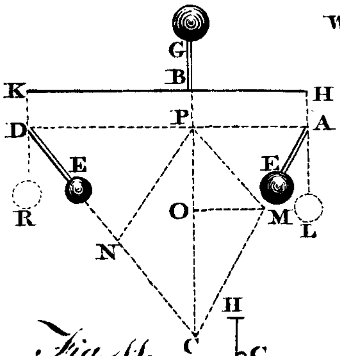


Fig. 36.

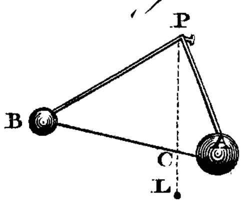


Fig. 39.

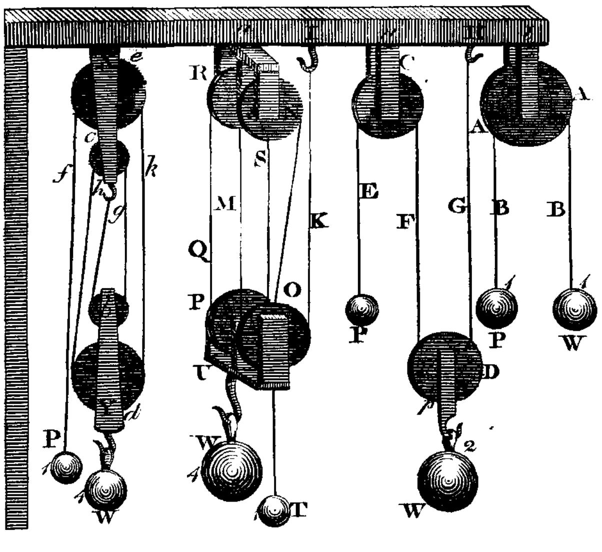


Fig. 41.

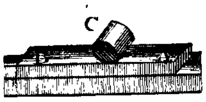


Fig. 37.

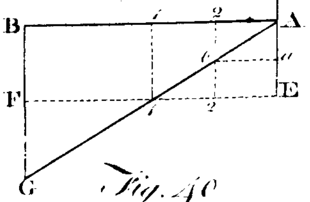


Fig. 38.

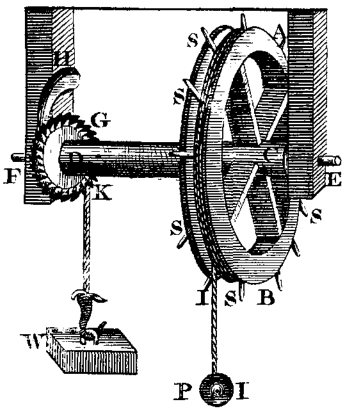


Fig. 40.

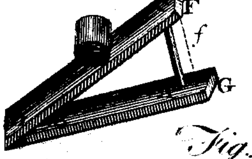


Fig. 43.

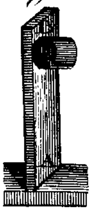


Fig. 42.

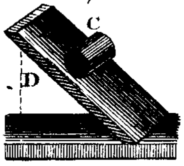


Fig. 44.

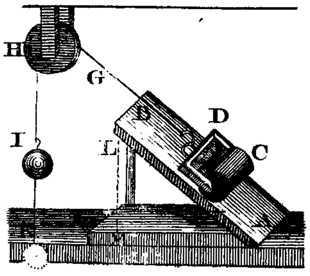
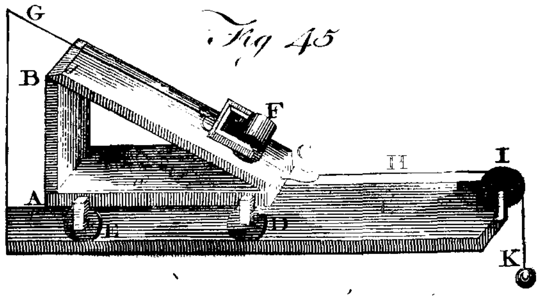


Fig 45



Smither Sculp.

the motion ultimately produced may have that direction and velocity which is moſt adapted to the execution of the ultimate deſign of the machine.

6. Of two machines, equal in other reſpects, that deſerves the preference in which the friction leaſt diminiſhes the effect propoſed by the whole.

To attain all theſe advantages in any machine is perhaps impoſſible; but in the application of the ſcrew, the following method promiſes to be attended with ſeveral of them.

Let A B (fig. 51.) be a plate of metal, in which the ſcrew C D plays, having a certain number of threads in an inch, ſuppoſe 10. Within the ſcrew C D there is a female ſcrew*, which receives the ſmaller ſcrew D E of 11 threads in an inch. This ſcrew is kept from moving about with the former by means of the apparatus at A F G B. But if the handle C K L be turned ten times round the ſcrew, C D will advance an inch upwards; and if we ſuppoſe the ſcrew D E to move round along with C D, the point E will advance an inch. If we now turn the ſcrew D E ten times backward, the point E will move downwards $\frac{10}{11}$ths of an inch, and the reſult of both motions will be to lift the point E $\frac{1}{11}$th of an inch upwards. But if, while the ſcrew C D is turned ten times round, D E be kept from moving, the effect will be the ſame as if it had moved ten times round with C D, and been ten times turned back; that is, it will advance $\frac{1}{11}$th of an inch. At one turn, therefore it will advance upwards $\frac{1}{11}\times\frac{1}{10}=\frac{1}{110}$ of an inch. If now the handle be ſix inches long, the power to produce an equilibrium muſt be to the weight as 1 to $110\times6.2832\times6=4146.912$. Thus the force of Mr Hunter's ſcrew is greatly ſuperior to that of the common one, for in order to have as great a power on the plan of the latter, it muſt have 110 threads in an inch, which would render it too weak to reſiſt any conſiderable violence.

With regard to the ſecond general maxim above laid down, Mr Hunter conſiders both kinds of ſcrews as equally applicable, only that the more complicated ſtructure, and conſequently greater expence of his ſcrew, renders it convenient to uſe the common ſcrew where only a ſmall increaſe of power is neceſſary, and his improved one where a great power is wanted. By ſhortening the handle alſo, the whole machine is rendered more portable and leſs troubleſome in the uſing.

To anſwer the fifth intention, both ſeem to be equally proper; but for the ſixth, the preference muſt be given to ſuch as beſt anſwer the particular purpoſe propoſed. Thus if the ſcrew D E be deſigned to carry an index which muſt turn round at the ſame time that it riſes upward, the common ſcrew is preferable; though our author alſo propoſes a method by which his ſcrew may anſwer the ſame purpoſe: With this view a ſtill ſmaller ſcrew ought to play within the ſcrew D E, and be connected with the ſcrew C D, ſo as to move round along with it. It muſt have, according to the foregoing proportions, 111 threads in an inch; and they muſt lie in a contrary direction to thoſe of C D; ſo that when they are both turned together, and C D moves upwards, this other may move downwards. At one turn this will move upwards $\frac{1}{12210}$th part of an inch, and at the ſame time will move in a circular direction; but the accuracy required in conſtructing ſuch ſcrews, even tho' made with fewer threads than thoſe juſt mentioned, would probably be too great for practice. In many caſes, however, ſcrews upon Mr Hunter's principles may be of conſiderable uſe.

32
Theory of the ſcrew.

The theory of the ſcrew is eaſily deduced from that of the inclined plane and lever; for the threads of the ſcrew in fact form a continued inclined plane, the height of which is the diſtance betwixt the two threads, and the length is the circumference of the cylinder. Hence, without any lever the ſcrew would have a conſiderable power, were it not for the great friction of the parts upon one another; and this friction would be much more increaſed by the perpendicular action of a weight on the top of the cylinder than by the horizontal action of a lever.

§ 7. *Other methods of accumulating power, which do not properly come under the denomination of any of the mechanical powers already deſcribed.*

From the account already given of the ſix mechanical powers, it is evident, that they can do no more than accumulate, or, if we may uſe the expreſſion, *compreſs*, any degree of velocity into a ſmall ſpace. The velocity thus compreſſed, becomes what we call *power*, and is capable of again impreſſing the original degree of velocity upon a body of an equal or nearly equal ſize to the firſt which originally impreſſed it; but in every caſe the abſolute quantity of motion, or of power, remains the ſame without a poſſibility of augmentation or diminution by levers, ſcrews, pulleys, or wedges. It follows, therefore, that if by any method we can preſerve for a certain time a ſmall quantity of motion, that will at the end of the time ſpecified amount to an aſtoniſhing power, which we could ſcarce at firſt have imagined to proceed from ſo ſmall a cauſe. Thus, though a man cannot raiſe a ton weight from the ground at once, he is eaſily capable of raiſing 100 pounds at once from the ground, and this for a conſiderable number of times in ſucceſſion. It is plain, therefore, that in a very ſhort time a man could in this manner raiſe the ton weight, if it were divided into 20 parts, as effectually as by a lever or other machine; though the fatigue conſequent upon ſtooping down and raiſing up his body ſo often would no doubt make the toil much greater. Even by means of a lever, however, before a man could raiſe a ton weight one foot from the ground, with the trouble of exerting a force equal to 100 pounds, he muſt have a lever 20 or 21 feet in length, and exert a conſtant force of 100 pounds, while he goes up through a ſpace of 20 feet, or pulls down a rope through that ſpace. The lever, therefore, only accumulates the power exerted in pulling or carrying the weight of 100 pounds through 20 feet, and diſcharges it all upon the ſpace of one foot; whence it is plain, that any other thing which could do this would raiſe the ton weight as effectually as the lever.

One method of accumulating a great power is by ſuſpending a very heavy body by a chain or ſtrong rope of conſiderable length. This body may be put in motion by a very ſmall degree of power more than is requiſite for bending the rope, and will acquire a vibratory motion like a pendulum; by continuing the impulſe as the body returns, it will continually acquire greater and greater force, the arches through which it

* See the article *Screw*.

it moves becoming continually larger, until at laſt it might be made to overcome almoſt any obſtacle: and upon this principle the battering rams of old were conſtructed, the power of which has been already mentioned; nevertheleſs the power of one ſtroke of this engine never could exceed the accumulated power of the impulſes given to it in order to produce that ſtroke, or even quite equal it, becauſe the ſtiffneſs of the rope, and the reſiſtance of the air, muſt always take off ſomething from it.

Another method of accumulating force is by means of a very heavy wheel or cylinder, moveable about an axis. A ſmall force will be ſufficient to put this wheel in motion; and, if long continued, will accumulate in ſuch a manner as to produce ſuch effects in raiſing weights and overcoming reſiſtances, as could not by any means be accompliſhed by the application of the original moving force. On this ſubject Mr Atwood has demonſtrated, that a force of 20 pounds applied for 37 ſeconds to the circumference of a cylinder of 10 feet radius, and weighing 4713 pounds, would, at the diſtance of one foot from the centre, give an impulſe to a muſket-ball equivalent to what it receives from a full charge of gun-powder. The ſame effect would be produced in ſix minutes and ten ſeconds by a man turning the cylinder with a winch one foot long, in which he conſtantly exerted a force of 20 pounds. In this caſe, however, as well as the former, there is not any abſolute accumulation of power; for the cylinder has no principle of motion in itſelf, and cannot have more than it receives.

33
Of the uſe of flies in various machines.

This accumulation of motion, however, in heavy wheels, is of great ſervice in the conſtruction of machines for various purpoſes, rendering them greatly more powerful and eaſy to be worked by animals, as well as more regular and ſteady, when ſet in motion by water, or any inanimate power. Hence the uſe of flies, ballaſt-wheels, &c. which are commonly ſuppoſed to increaſe the power of a machine, though in reality they take ſomething from it, and act upon a quite different principle.—In all machines in which flies are uſed, a conſiderably greater force muſt at firſt be applied than what is neceſſary to move the machine without it, or the fly muſt have been ſet in motion ſome time before it is applied to the machine. It is this ſuperfluous power which is collected by the fly, and ſerves as a kind of reſervoir from which the machine may be ſupplied when the animal ſlackens his efforts. This, we muſt obſerve, will always be the caſe with animals, for none are able to exert a great power with abſolute conſtancy; ſome intervals of reſt, even though almoſt imperceptible, are requiſite, otherwiſe the creature's ſtrength would in a ſhort time be entirely exhauſted. When he begins to move the machine he is vigorous, and exerts a great power; in conſequence of which he overcomes not only the reſiſtance of the machine itſelf, but communicates a conſiderable degree of power to the fly. The machine, when moving, yields for a time to a ſmaller impulſe; during which time the fly itſelf acts as moving power, and the animal recovers the ſtrength he had loſt. By degrees, however, the motion of the machine decreaſes, and the animal is obliged to renew his efforts. The velocity of the machine would now be conſiderably increaſed, were it not that the fly now acts as a reſiſting power, and the greateſt part of the ſuperfluous motion is lodged in it, ſo that the increaſe of velocity in the machine is ſcarcely perceptible. Thus the animal has time to reſt himſelf until the machine again requires an increaſed impulſe, and ſo on alternately.—The caſe is the ſame with a machine moved by water, or by a weight; for tho' the ſtrength of theſe does not exhauſt itſelf like that of an animal, yet the yielding of the parts of the machine renders the impulſe much leſs after it begins to move: hence its velocity is accelerated for ſome time, until the impulſe becomes ſo ſmall that the machine requires an increaſe of power to keep up the neceſſary motion. Hence the machine ſlackens its pace, the water meets with more reſiſtance, and of conſequence exerts its power more fully, and the machine recovers its velocity. But when a fly is added to the other parts, this acts firſt as a power of reſiſtance, ſo that the machine cannot acquire the velocity it would otherwiſe do. When it next begins to yield to the preſſure of the water, and the impulſe of courſe to ſlacken, the fly communicates part of its motion to the other parts; ſo that if the machine be well made, there is very little difference in the velocity perceptible.—The truth of what is here advanced will eaſily be ſeen, from conſidering the inequality of motion in a clock when the pendulum is off, and how very regularly it goes when regulated by the pendulum, which here acts as a fly.

34
Of the weight of flies.

Flies are particularly uſeful in any kind of work which is done by alternate ſtrokes, as the lifting of large peſtles, pumping of water, &c. In this caſe the weight of the wheel employed is a principal object; and the method of calculating this is to compare it with the weight to be raiſed at each ſtroke of the machine. Thus, ſuppoſe it required to raiſe a peſtile 30 pounds weight to the height of one foot 60 times in a minute: Let the diameter of the fly be ſeven feet, and ſuppoſe the peſtle to be lifted once at every revolution of the fly; we muſt then conſider what weight paſſing through 22 feet in a ſecond will be equivalent to 30 pounds moving through one foot in a ſecond. This will be $30 \div 22$ or $1\frac{4}{15}$ pounds. Were a fly of this kind to be applied, therefore, and the machine ſet a going, the fly would juſt be able to lift the peſtle once after the moving power was withdrawn; but by increaſing the weight of the fly to 10, 12, or 20 pounds, the machine when left to itſelf would make a conſiderable number of ſtrokes, and be worked with much leſs labour than if no fly had been uſed, though no doubt at the firſt it would be found a conſiderable incumbrance to the motion. This is equally applicable to the action of pumps; but the weight which can be moſt advantageouſly given to a fly has never yet been determined by mechanics. It is certain, however, that the fly does not communicate any abſolute increaſe of power to the machine; for if a man or other animal is not able to ſet any mechanical engine in motion without a fly, he will not be able to do it, though a fly be applied, nor will he be able to keep it in motion though ſet a-going with a fly by means of a greater power. This may ſeem to be contradicted by the example of a common clock; for if the pendulum be once ſtopped, the weight is not able to ſet it in motion again, though it will keep it going when once put in motion by an external power. This, however, depends

depends not upon any inſufficiency of the weight, but on the particular mechaniſm of the crown wheel; which is ſuch, that when once the pendulum is ſtopped, it would require a much greater weight than that commonly applied to ſet it in motion; and if the uſual weight was to act fairly, it would be more than ſufficient to move all the machinery, and make the pendulum vibrate alſo with much greater force than it does.

§ 8. *Of Friction.*

The doctrine of friction, according to Mr Ferguſon, may be ſummed up in the following manner: 1. When one body inſiſts on another upon a horizontal plane, it preſſes it with its whole weight; which being equally reacted on, and conſequently the whole effect of its gravity deſtroyed by the plane, it will be abſolutely free to move in any horizontal direction by any the leaſt power applied thereto, provided both the touching ſurfaces be perfectly ſmooth. 2. But ſince we find no ſuch thing as perfect ſmoothneſs in the ſurfaces of bodies, but an evident roughneſs or unevenneſs of the parts in their ſurface, ariſing from their poroſity and peculiar texture, it is eaſy to underſtand, that, when two ſuch ſurfaces come together, the prominent parts of one will in ſome meaſure fall into the concave parts of the other; and therefore, when an horizontal motion is attempted in one, the fixed prominent parts of the other will give more or leſs reſiſtance to the moving ſurface, by holding and detaining its parts; and this is what we call *friction*. 3. Now ſince any body will require a force proportional to its weight to draw it over a given obſtacle, it follows, that the friction ariſing to the moving body will always be in proportion to its weight only, and not the quantity of the ſurface by which it bears upon the reſiſting plane or ſurface. Thus, if a piece of wood four inches wide and one thick be laid upon another fixed piece of the ſame wood, it will require the ſame weight to draw it along, whether it be laid on its broad or narrow ſide. 4. For though there be four times the number of touching particles on the broad ſide (*cæteris paribus*), yet each particle is preſſed with but $\frac{1}{4}$th of the weight that thoſe are on the narrow ſide; and ſince four times the number, multiplied by $\frac{1}{4}$th of the weight, is equal to $\frac{1}{4}$th of the number multiplied by four times the weight, it is plain the reſiſtance is equal in both caſes, and ſo requires the ſame force to overcome it. 5. The reaſon why friction is proportional to the weight of the moving body is, becauſe the power applied to move the body muſt raiſe it over the prominent parts of the ſurface on which it is drawn; and this motion of the body, as it is not upright, ſo it will not require a power equal to its whole weight; but being in the nature of the motion on an inclined plane, it will require only a part of its own weight, which will vary with the various degrees of ſmoothneſs and aſperity. 6. It is found by experiment, that a body will be drawn along by nearly $\frac{1}{3}$d of its weight; and if the ſurfaces be hard and well poliſhed, by leſs than a third part; whereas if the parts be ſoft or ragged, it will require a much greater weight. Thus alſo the cylinder of wood AB, if Fig. 54. very ſmooth, and laid on two well poliſhed ſupporters CD (having been firſt oiled or greaſed), and then charged with the weight of two pounds in the two equal balls GH, it will require an additional weight x, equal to about a third part of the two pounds, to give motion to or overcome the friction of the ſaid cylinder. 7. Now this additional weight, as it cauſes a greater weight of the cylinder, will likewiſe increaſe the friction; and therefore require the addition of another weight y, equal to the third part of its own weight; for the ſame reaſon, the weight y will require another z, a third part leſs; and ſo on *ad infinitum*. Hence, ſuppoſing the friction to be preciſely a third of the weight, the firſt weight with all the additional ones, *viz.* 2, $\frac{2}{3}$, $\frac{2}{9}$, $\frac{2}{27}$, &c. will be a ſeries of numbers in geometrical progreſſion decreaſing. Now the ſum of all theſe terms, except the firſt, is found, by a well-known theorem in arithmetic, to be equal to one pound. So that if the weight of the cylinder be inconſiderable, the readieſt way to overcome the friction would be to double the power G, or H, at once. 8. But though we may, at a medium, allow a third part of the weight with which any ſimple machine is charged for the friction ariſing from thence, yet this is very precarious, and ſeldom is the caſe: for if ABCD be a piece of braſs of ſix ounces, Fig. 55. and EFGH be alſo a plate of braſs, and both the ſurfaces well ground and poliſhed, the weight P of near two ounces will be required to draw along the body AC alone; but if AC be loaded with 6, 8, or 10lb. then a ſixth part of the weight will be ſufficient to draw it along the plane. On the other hand, if the plane be covered with a linen or woollen cloth, then a third or half part, and ſometimes more, will be requiſite to draw it along on the plane. 9. Yet notwithſtanding the difficulty and uncertainty attending the eſtimation of the quantity of friction, it is ſtill a moſt uſeful and neceſſary inquiry, how and by what means the friction of any machine may be diminiſhed? In order to this, we muſt conſider friction mechanically, or as a force acting againſt a power applied to overcome it. Thus ſuppoſe AB an upright ſtem Fig. 56. or ſhaft, turning freely in the ſocket B fixed in the table or plane IKLM; and AC, DE, two arms fixed in the ſaid ſhaft, the latter of which, DE, has three pins going into a ſocket in the middle of heavy weights, F, G, or H, in ſuch a manner, that when a power applied at C moves the lever AC, it cauſes the lever DE to protrude or thruſt along the weights at F, G, or H, in a circular manner upon the table. 10. Now ſince we ſuppoſe the weight, all the while it is in motion, is freely and wholly ſupported by the plane, it follows, that all the reſiſtance it can give to the power applied to C, is only what ariſes from its friction on the plane. What this friction is, will be found by applying the weight at G, ſo that BG be equal to AC; for then the power applied to C, acting in a tangent to the circle CRS, that ſhall juſt move the weight G, will be equal to its friction. But if the weight be applied at F, becauſe BF is greater than AC, the ſame power at C, as before, will not move it, by reaſon its force is here increaſed, by having a greater velocity than the power; as, on the other hand, if placed at H, a leſs power at C ſhall move it, becauſe of its having there leſs velocity than the power, as is evident from the properties of the lever. 11. Hence we underſtand, that though the weight of a machine remains the ſame; yet the friction may be diminiſhed, by contriving that the parts on which it moves and rubs ſhall have leſs velocity than the power which moves it: thus, if the cylinder AB (fig. 54.) were to move on the two ſmall pins or gudgeons E, F, the friction would be abated in the proportion of the diameter of the cylinder to that of the pins. 12. The friction on theſe gudgeons is ſtill farther diminiſhed by cauſing them to move on the circumference of a wheel: thus, let F be the gudgeon of the cylinder, revolving on the wheel CDE (fig. 57.), the velocity of the wheel's circumference will be the ſame with that of the gudgeon; but the velocity of the wheel's axis AB (which is now to be conſidered as the rubbing part) is leſs than that of the wheel, in proportion as its diameter is leſs than that of the wheel: for example, if the friction of the cylinder moving on its ſurface be $\frac{1}{3}$d part of the weight, and the gudgeon be to the cylinder as 1 : 10, they will reduce the friction to $\frac{1}{30}$th part; and if, again, the axis of the wheel be to the wheel as 1 : 10, the wheel will reduce the friction to $\frac{1}{300}$th part; and if the axis of this wheel be laid on the perimeter of another wheel, the friction will be reduced to a ſtill leſſer part of the weight; ſo that you may proceed in this manner to diminiſh the friction *ad infinitum;* and wheels applied in this manner are called *friction-wheels.* 13. Beſides what has been already ſaid, ſomewhat farther is neceſſary to diminiſh the friction of wheel-carriages. It was before obſerved, that friction aroſe chiefly by lifting the body over the prominent parts of the plane on which it is moved: now if we can contrive to move the body along without lifting or ſuſtaining its weight, we ſhall move it without much friction; and this may be done by laying the body on any moveable circular ſubject as rollers, wheels, &c.: becauſe the aſperities of its ſurface will lay hold on thoſe of the roller, and move it likewiſe; and it is as evident, that when the body is drawn againſt the prominent parts of the roller, they immediately give way, and make no reſiſtance. By this circular motion of the roller, its prominent parts below do only deſcend and move upon or over, and are not drawn againſt, the fixed prominent parts of the plane, and ſo receive no reſiſtance from them. Hence the body is conveyed along without being lifted up, in the ſame manner as a wheel is moved by a pinion without any conſiderable reſiſtance.

Sect. III. *Of the Combinations of the Mechanical Powers.*

From what has been already laid down concerning the mechanical powers in particular, we have ſeen that none of them is capable of augmenting the abſolute force of any acting ſubſtance; and from thence we may juſtly conclude, that no combination of them can do ſo. In fact, theſe combinations are very often detrimental, and occaſion a great loſs of power by friction. This is the great obſtacle in mechanics, and muſt always be greater in complex than in ſimple machines; and therefore the latter are always to be preferred, excepting where conveniency requires ſome degree of complication. The lever being the ſimpleſt machine, and that attended with leaſt friction, is always to be uſed where it is requiſite to raiſe weights for a ſmall way. It may likewiſe be uſed with propriety where bodies are to undergo a long continued degree of preſſure, and where they yield but little. For this purpoſe the lever ought to be of the ſecond kind, repreſented fig. 28. where one end being fixed at A, a weight may be put upon the other extremity B, and the body to be preſſed put at 1, 2, or any of the intermediate diviſions, according to the degree of preſſure it is deſigned to undergo. This has the advantage of giving a long and very adequate preſſure, and is a very advantageous method of preſſing cheeſe or other things which do not require a very great exertion of force. Where this is requiſite we muſt employ wedges or ſcrews; but both theſe have the diſadvantage of ſlackening their preſſure on the leaſt yielding of the materials to be preſſed. Wedges therefore require to be almoſt conſtantly driven, and ſcrews to be turned by a lever, in order to produce a conſtant preſſure. In oil mills the preſſure is produced by wedges, which are conſtantly driven by great mallets lifted up by the force of the mill. Oil of ſweet almonds is made by apothecaries in a preſs driven by a ſcrew, and turned by a long lever aſſiſted by a capſten.

Plate CCLXXXIII.

Where it is neceſſary to have a conſiderable weight raiſed to ſome height, the pulley is the moſt uſeful power, but the friction is extremely great; the axis in peritrochio combined with a ſingle pulley will anſwer the purpoſe extremely well, and with leſs friction than any machine compoſed of pulleys alone. The machines called *cranes* are generally combinations of theſe two; and are very much uſed, eſpecially by the commercial people, for raiſing goods out of ſhips, drawing them up into warehouſes, and for lowering them down. In theſe operations we muſt obſerve, that lowering goods is much more dangerous than raiſing them, on account of the vaſt increaſe of velocity which bodies acquire every moment by the power of gravity. In the conſtruction of cranes, therefore, it is abſolutely neceſſary to attend to this circumſtance, and to guard againſt accidents. The following are recommended by Mr Ferguſon: Fig. 52. ſhows one crane well calculated for the purpoſes juſt mentioned. When the rope H is hooked to the weight K, a man turns the winch A, on the axis whereof is the trundle B, which turns the wheel C, on whoſe axis D is the trundle E, which turns the wheel F with its upright axis G, on which the great rope HH winds as the wheel turns; and going over a pulley I, at the end of the arm *d* of the gib *ccde*, it draws up the heavy burden K; which being raiſed to a proper height, as from a ſhip to the quay, is then brought over the quay by pulling the wheel Z round by the handles *z*, *z*, which turns the gib by means of the half wheel *b* fixed on the gib-poſt *cc*, and the ſtrong pinion *a* fixed on the axis of the wheel Z. This wheel gives the man that turns it an abſolute command over the gib, ſo as to prevent it from taking any unlucky ſwing, ſuch as often happens when it is only guided by a rope tied to its arm *d*; and people are frequently hurt, ſometimes killed, by ſuch accidents.

35 Beſt method of conſtructing cranes.

Plate CCLXXXV.

The great rope goes between two upright rollers *i* and *k*, which turn upon gudgeons in the fixed beams *f* and *g*; and as the gib is turned towards either ſide, the rope bends upon the roller next that ſide. Were it it not for theſe rollers, the gib would be quite unmanageable; for the moment it were turned ever ſo little towards any ſide, the weight K would begin to deſcend, becauſe the rope would be ſhortened between the pulley I and axis G; and ſo the gib would be pulled violently to that ſide, and either be broken to pieces or break every thing that came in its way. Theſe rollers muſt be placed ſo that the ſides of them round which the rope bends may keep the middle of the bended part directly even with the centre of the hole in which the upper gudgeon of the gib turns in the beam *f*. The truer theſe rollers are placed, the eaſier the gib is managed, and the leſs apt to ſwing either way by the force of the weight K.

A ratchet-wheel Q is fixed upon the axis D, near the trundle E; and into this wheel falls the catch or click R. This hinders the machine from running back by the weight of the burden K, if the man who raiſes it ſhould happpen to be careleſs, and to leave off working at the winch A ſooner than he ought to do.

When the burden K is raiſed to its proper height from the ſhip, and brought over the quay by turning the gib about, it is let down gently upon the quay, or into a cart ſtanding thereon, in the following manner: A man takes hold of the rope *tt* (which goes over the pulley *v*, and is tied to a hook at S in the catch R), and ſo diſengages the catch from the ratchet-wheel Q; and then, the man at the winch A turns it backward, and lets down the weight K. But if the weight pulls too hard againſt this man, another lays hold of the handle V, and by pulling it downward draws the gripe U cloſe to the wheel Y, which by rubbing hard againſt the gripe hinders the too quick deſcent of the weight; and not only ſo, but even ſtops it at any time if required. By this means, heavy goods may be either raiſed or let down at pleaſure, without any danger of hurting the men who work the engine.

When part of the goods are craned up, and the rope is to be let down for more, the catch R is firſt diſengaged from the ratchet-wheel Q, by pulling the cord *t*; then the handle *q* is turned half round backward, which, by the crank *n n* in the piece *o*, pulls down the frame *h* between the guides *m* and *m* (in which it ſlides in a groove), and ſo diſengages the trundle B from the wheel C; and then the heavy hook β at the end of the rope H deſcends by its own weight, and turns back the great wheel F with its trundle E and the wheel C; and this laſt wheel acts like a fly againſt the wheel F and hook β, and ſo hinders it from going down too quick; whilſt the weight X keeps up the gripe U from rubbing againſt the wheel Y, by means of a cord going from the weight over the pulley *w* to the hook W in the gripe; ſo that the gripe never touches the wheel unleſs it be pulled down by the handle V.

When the crane is to be ſet at work again for drawing up another burden, the handle *q* is turned half round forwards; which, by the crank *n n*, raiſes up the frame *h*, and cauſes the trundle B to lay hold of the wheel C; and then, by turning the winch A, the burden of goods K is drawn up as before.

The crank *n n* turns pretty ſtiff in the mortiſe near *o*, and ſtops againſt the farther end of it when it has got juſt a little beyond the perpendicular; ſo that it can never come back of itſelf: and therefore the trundle B can never come away from the wheel C until the handle *q* be turned half round.

The great rope runs upon rollers *pp* in the lever L M, which keep it from bending between the axle at G and the pulley I. This lever turns upon the axis N by means of the weight O, which is juſt ſufficient to keep its end L up to the rope; ſo that, as the great axle turns, and the rope coils round it, the lever riſes with the rope, and prevents the coilings from going over one another.

The power of this crane may be eſtimated thus: Suppoſe the trundle B to have 13 ſtaves or rounds, and the wheel C to have 78 ſpur-cogs; the trundle E to have 14 ſtaves, and the wheel F 56 cogs: then, by multiplying the ſtaves of the trundles, 13 and 14, into one another, their product will be 182; and by multiplying the cogs of the wheels, 78 and 56, into one another, their product will be 4368: and dividing 4368 by 182 the quotient will be 24: which ſhows that the winch A makes 24 turns for one turn of the wheel F and its axle G, on which the great rope or chain H I H winds. So that if the length or radius of the winch A were only equal to half the diameter of the great axle G, added to half the thickneſs of the rope H, the power of the crane would be as 24 to 1: but the radius of the winch being double the above length, it doubles the ſaid power, and ſo makes it as 48 to 1: in which caſe, a man may raiſe 48 times as much weight by this engine as he could do by his natural ſtrength without it, making proper allowance for the friction of the working parts. Two men may work at once, by having another winch on the oppoſite end of the axis of the trundle under B, and ſo make the power ſtill double.

If this power be thought greater than what may be generally wanted, the wheels may be made with fewer cogs in proportion to the ſtaves in the trundles; and ſo the power may be of whatever degree is judged to be requiſite. But if the weight be ſo great as will require yet more power to raiſe it (ſuppoſe a double quantity), then the rope H may be put under a moveable pulley, as δ, and the end of it tied to a hook in the gib at ε; which will give a double power to the machine, and ſo raiſe a double weight hooked to the block of the moveable pulley.

When only ſmall burdens are ſo raiſed, this may be quickly done by men puſhing the axle G round by the handſpokes *y*, *y*, *y*, *y*; having firſt diſengaged the trundle B from the wheel C: and then this wheel will only act as a fly upon the wheel F; and the catch R will prevent its running back, if the men ſhould inadvertently leave off puſhing before the burden be unhooked from β.

Laſtly, when very heavy burdens are to be raiſed, which might endanger the breaking of the cogs in the wheel F; their force againſt theſe cogs may be much abated by men puſhing round the handſpokes *y*, *y*, *y*, *y*, whilſt the man at A turns the winch.

We have only ſhown the working parts of this crane, without the whole of the beams which ſupport them; knowing that theſe are eaſilly ſuppoſed, and that if they had been drawn, they would have hid a great deal of the working parts from ſight, and alſo confuſed the figure.

Another very good crane is made in the following

36 Another crane.

manner: AA (fig. 53.) is a great wheel turned by men walking within it at H. On the part C, of its axle, BC, the great rope D is wound as the wheel turns; and this rope draws up goods in the ſame way as the rope HH does in the abovementioned crane, the gib-work here being ſuppoſed to be of the ſame ſort. But theſe cranes are very dangerous to the men in the wheel; for if any of the men ſhould chance to fall, the burden will make the wheel run back and throw them all about within it; which often breaks their limbs, and ſometimes kills them. The late ingenious Mr Padmore of Briſtol, England, (whoſe contrivance the fore-mentioned crane is), obſerving this dangerous conſtruction, contrived a method for remedying it, by putting cogs all around the outſide of the wheel, and applying a trundle E to turn it; which increaſes the power as much as the number of cogs in the wheel is greater than the number of ſtaves in the trundle: and by putting a ratchet-wheel F on the axis of the trundle (as in the abovementioned crane), with a catch to fall into into it, the great wheel is ſtopt from running back by the force of the weight, even if all the men in ſhould leave off walking. And by one man working at the winch I, or two men at the two oppoſite winches when needful, the men in the wheel are much aſſiſted, and much greater weights are raiſed, than could be by men only within the wheel. Mr Padmore put alſo a gripe-wheel G upon the axis of the trundle, which being pinched in the ſame manner as deſcribed in the former crane, heavy burdens may be let down without the leaſt danger. And before this contrivance, the lowering of goods was always attended with the utmoſt danger to the men in the wheel; as every one muſt be ſenſible of who has ſeen ſuch engines at work. And it is ſurpriſing that the maſters of wharfs and cranes ſhould be ſo regardleſs of the limbs, or even lives of their workmen, that, excepting the late Sir James Creed of Greenwich, and ſome gentlemen at Briſtol, there is ſcarce an inſtance of any who has uſed this ſafe contrivance.

37 Mr Gottlieb's new crane.

Plate CCLXXXVI,

We ſhall deſcribe here four new cranes invented and made by Mr Gottlieb of Hounſditch, London, who communicates them to the public as quite new in their principles, and more ſimple and uſeful than any hitherto contrived. Fig. 59. is a repreſentation of a crane adapted for a large warehouſe, where heavy goods are wanted to be drawn up from a cart or quay. One of this conſtruction has lately been erected in Mr Camden's ſugar-houſe, Old Gravel-Lane, London. Its operation is as follows: The horſe yoked below at A turns the upright axis and the wheel B, which is about 6 feet in diameter; this turns a 3 feet wheel C, having an upright axis D through the floor turning with it, and carrying a 3 feet wheel E with perpendicular cogs. The wheel E turns two pinions F and G, the former of 8 inches in diameter, and the latter of 5 inches diameter, both fixed upon one axis. The pinion G turns a 3 feet wheel H, to which is fixed the barrel I and wheel W. The rope K winds round the barrel, and comes over the ſheiff-wheel L in the upper ſtory, and the pulley M in the gib-head drawing up the goods ſuſpended at the hook N.

By a mark made upon the rope at I, the man ſuperintending the crane knows when the goods are raiſed enough for landing into the room: he then immediately puſhes aſide the upright piece O, diſengages the lever P from it; and by putting it downwards, the action of the quarter pinion at Q raiſes up the pinion at G, and thereby unconnects it with the wheel H. To prevent the machinery now from running backwards, a ratchet-wheel R is fixed upon the wheel H, into which a click-catch S falls. This effectually prevents the wheels going backwards by the weight at N while the man above is employed in landing the goods. When the goods are brought into the ſtore-room, the hook N is thrown out, and the man below, from the uſual call, runs to the handle U, ſlides the pinion T into the wheel H, then turns back the ratchet-wheel R, and puſhes back the click S, then ſlides back again the pinion T; and the wheel H and barrel I being thus at liberty, the hook N and rope run down by their own gravity, and freſh goods are attached; then again, from the uſual call, the man puſhes up the lever P, fixes it at O, places the click S into the teeth of the ratchet-wheel; and the whole machinery is again in action from the horſe below, that keeps conſtantly going without being ſtopped at every ſhort interval of the landing, ſtoring, &c.

When the goods are to be carted off, and required to be let down only, it is performed without the horſe, and in the following manner: The pinion G is diſengaged from the wheel H by the lever P as before, and the pinion V of the fly-wheel is ſlipped into the teeth of the 2 feet wheel W. The goods being ſuſpended at N, will act by the rope upon the wheel W and pinion V, thereby turning round the fly-wheel X: while the goods are thus deſcending, the man preſſes upon the lever Y, and bears againſt the wheel, making ſuch a reſiſtance as to be ſufficient to allow the goods to deſcend with as gentle a degree of motion as may be neceſſary.

The hook N being taken from the goods, the man goes to the wheel W, and with his hands turns it round, which winds up the cord and hook in readineſs for more goods, and ſo on as before. The pinions T and V in this caſe are ſlipped out of the wheels H and W.

As the horſe at A may likewiſe be uſed to turn other mill-work from a connection made with the main-wheel, and ſuppoſing that the crane is not wanted at the ſame time, it is readily diſengaged by turning of the winch at Z; which, by the pinion *a* below, working into the teeth of the bar, and the wheel C which turns upon it, quite unconnects the wheel C from the crane.

It is therefore evident from what has been deſcribed, that this crane can be managed by two men only, and occaſionally without a horſe, when very heavy goods are not raiſed. All the neceſſary beams for fixing the machinery by, could not be repreſented in the figure without obſcurity and confuſion; but theſe being omitted, will not to the moſt ordinary mechanic render the general conſtruction of the crane difficult to underſtand.

38 New cellar crane.

A new portable cellar crane is repreſented in fig. 60. which is very uſeful to wine-merchants, brewers, &c. in drawing up and letting down caſks full of wine, beer, &c. It ſaves the trouble and inconvenience of horſes, and in many places can be uſed where horſes could not. AA are two wooden props about 6 feet in height, and

Fig. 46.

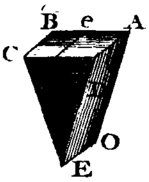


Fig. 52.

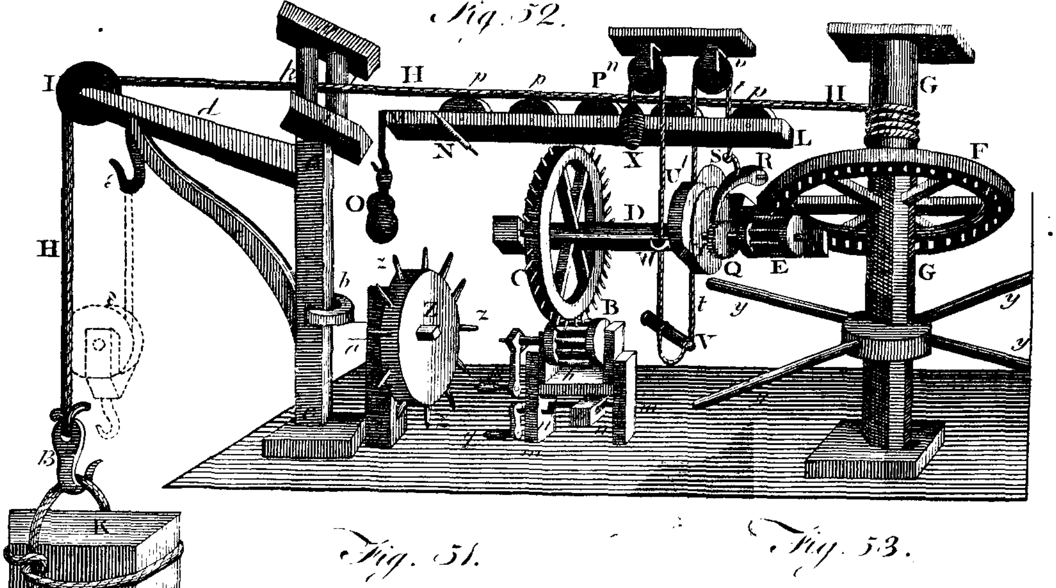


Fig. 47.

Fig. 48.

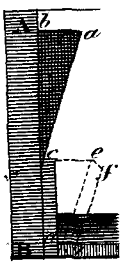


Fig. 51.

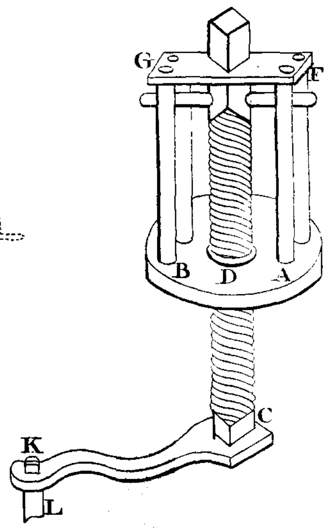


Fig. 53.

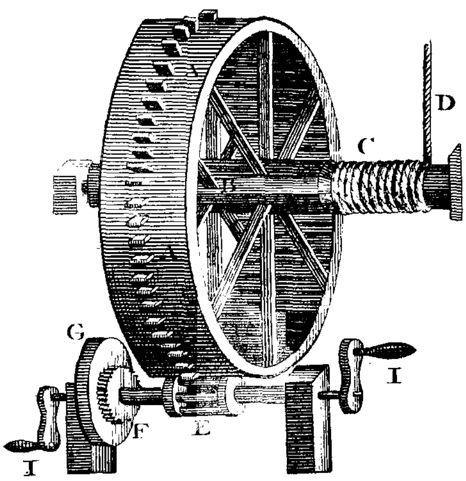


Fig. 49.

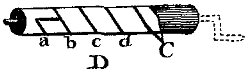


Fig. 50.

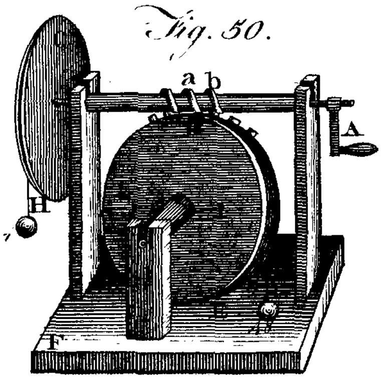


Fig. 56.

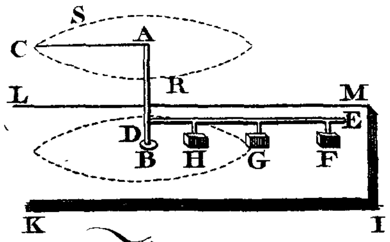


Fig. 55.

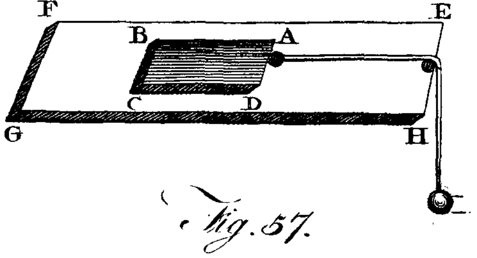


Fig. 54.

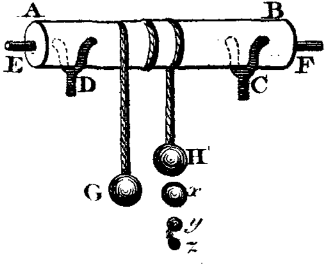


Fig. 57.

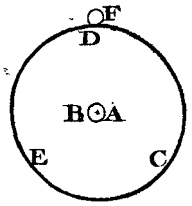
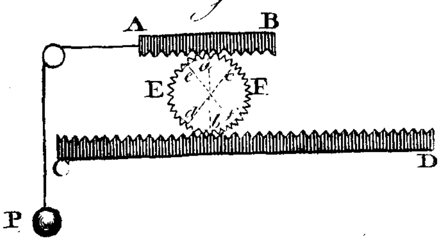


Fig. 58.



Smither sculp.

and jointed together like a ruler at E. They are connected to each other by an iron round bar C and wooden bar at the bottom D. The iron prongs EE faſten the uprights ſteadily to the edge of the cellar; F is the axis round which two ropes are coiled, the ends of which are faſtened to the two clamps GG. On the axis F is fixed the iron wheel H of 3 feet in diameter: in the teeth of this works the pinion I of about 6 or 7 inches in diameter, and is turned by the handle at K.

It is evident, by a bare inſpection of the figure, that when the two ropes are ſlipt over the ends upon the barrel, either at the top or bottom of the cellar, that by turning of the winch K towards or from you, the barrel can be ſafely or expeditiouſly taken out or lowered down.

When the crane is done with, it ſhuts up by unſcrewing the nut at B, taking the wheel and axis away out of the loops at L, and folding the ſides at A together like a jointed rule; it may then be taken away in the cart or dray, or taken in the mens hands.

39 Portable ſtone-crane.

Fig. 61. repreſents a portable ſtone-crane mounted in a wooden frame and ſtage, which is judged to be very uſeful for loading and unloading carts with large heavy ſtones. It is moveable to any part of a ſtone-yard or ground; the frame is ſufficiently wide for a cart to draw under the crane, and at any time it may be taken to pieces.

The frame AAAA is made of wood, is about 9 or 10 feet high, and about 9 feet ſquare. The wheels BB are of iron, and are about 3 feet in diameter, and the pinion D, that is fixed to the axis of the firſt wheel B, 8 inches in diameter, on the axis of the ſecond wheel B, the axis round which the rope-coils are fixed.

Now the ſtones being corded and hooked at the end of the rope, it is very evident that the man at C will either raiſe or lower them as may be neceſſary, according as he turns the winch towards or from him, and in a ſafe and very eaſy manner.

40 Crane carriage.

Fig. 62. is a repreſentation of a crane-carriage which Mr Gottleib conceives it to be very uſeful in moving large ſtones in quarries, where carts and horſes cannot be conveniently or at all managed. Its principle is evidently clear from a bare view of the figure. It conſiſts only of two ſets of crane-wheels applied to the two ſets of wheels belonging to the carriage; ſo that two men, one at each winch AA, turning the pinions and wheels round, ſhall act upon the carriage-wheels and move it along. By their both turning forwards or backwards, the carriage goes accordingly; but if they turn contrary-ways, the carriage will be turned round, or partly ſo, as may be wanted.

The pinion B is 6 inches in diameter, which turns the wheel C of 3 feet diameter, on the axis of which is fixed the pinion D of 1 foot diameter, which works into 2 wheels E, E, of 3 feet 6 inches diameter, that are fixed upon the carriage-wheels, and give motion to the whole machine.

The friction of the axle-trees of theſe machines may be conſiderably diminiſhed, by applying an improved axle-tree invented by Mr Gottleib, which he calls the *anti-attrition axle-tree*, and for which he has a patent. It is formed from a ſteel-roller, from 4 to 6 inches long, turning within a groove cut in the iron part of the axle; and the advantages diſcovered by experiments made by Mr Gottleib will be ſeen by the ſmall table ſubjoined. A ſection of this axle-tree is repreſented in fig. 65. where *a* is the axle-tree, *b* the groove, *c* the roller, *d* the cavity between the lower part of the tree and the box *e*. In figs. 66, 67, *f* repreſents the oil-veſſel ſupplying it with oil, *g* the tube to convey the oil by, *h* the ſtraps of ditto, *i* the faſtening ſcrews. Figs. 63, 64, give a ſide view of the axle.

Plate CCLXXXVII.

Advantage of the anti-attrition axle-tree.

	Old axle-tree.			Anti-attrition.	
	lb.	oz.		lb.	oz.
Coaches -	60	0	only	19	0
Chariots, poſt-chaiſes, &c.	49	1		17	6
Single horſe chaiſes and chairs - -	31	7		6	8
Waggons - -	78	0		33	0
Drays for beer -	138	0		48	0

One general maxim to be kept in mind by all mechanics is, that whatever a machine gains in power it loſes in time, even ſuppoſing friction were entirely out of the queſtion. It muſt likewiſe be remembered, that in almoſt all caſes where a machine gains by complication, it will loſe one third by mere friction, unleſs its parts are made with an accuracy not to be expected. In ſome caſes, however, a great power muſt be had; and in theſe we muſt have recourſe to the moſt ſimple machines, which will loſe only time, and but little power by friction; for the complicated ones waſte both time and power to a great degree. There is not perhaps a better method of procuring a very great power than by combining a ſcrew with a toothed wheel which acts as an axis in peritrochio, as is repreſented fig. 50; for by making the threads of the ſcrew pretty cloſe, and the diameter of the wheel large, we may increaſe the power almoſt to any degree we pleaſe, without any conſiderable increaſe of friction. In this caſe, where it can conveniently be done, it is better to increaſe the diameter of the wheel than to add another, for this augments the power without any ſenſible augmentation of the friction; and it is abſolutely neceſſary to have the axle as ſmall as can be made of ſufficient ſtrength to bear the weight. Archimedes is ſaid to have boaſted, that he could move the earth provided he could find a place to ſtand on; and Biſhop Wilkins, that he could pull the ſtrongeſt oaks up by the roots by means of a ſingle horſe-hair. But abſtracting from the impoſſibility in the caſe of Archimedes, it does not appear that the biſhop could more eaſily have fulfilled his taſk, on account of the immenſe friction of the machine he muſt have employed, and the ſtiffneſs of the great ropes which muſt have been bent in order to accompliſh his purpoſe. To perform feats of this kind, a lever ſeems more likely than any thing; but the vaſt room it takes up, and the exceſſive length requiſite to make it act with ſufficient force, together with the vaſt weight it muſt neceſſarily have if made of the requiſite ſtrength, muſt eaſily convince us that all ſuch extrrvagant boaſts are vain, and that wherever great effects are to be accompliſhed, a great power muſt originally be applied.

Plate CCLXXXV.

Sect. IV. *Of Wheel-carriages.*

Wheel carriages in general ſignify all kinds of machines furniſhed with wheels, for drawing great weights by means of the ſtrength of animals or otherwiſe.

41
Sledges uſed before wheel-carriages,

It is very probable, that in the infancy of the arts, ſledges were uſed before wheels were invented, or at leaſt before the application of them became very general. Homer mentions them as employed in bringing wood for the funeral of Patrocles; though it is not to be doubted that the Greeks at that time were acquainted with the uſe of wheels, as the ſame poet mentions them on all occaſions when ſpeaking of the war chariots of his heroes. It is poſſible, therefore, that by the country people, for inferior purpoſes, the ſledge might be employed, while wheel-carriages were confined to thoſe of ſuperior rank, or uſed only for war-chariots. It is not long ago indeed ſince ſledges were uſed for certain purpoſes in Britain, notwithſtanding the number of wheel-carriages uſed in it from time immemorial. In ſome of the cold countries, where ice is met with in great quantity, and the ground is covered with frozen ſnow for a great part of the year, ſledges are ſtill uſed, and run upon the ſmooth ſurfaces of theſe bodies with as great eaſe as wheels run upon the ordinary ground. Upon very ſmooth ice, indeed, or upon any body perfectly ſmooth, wheels would not turn at all; for the only reaſon why they turn in the ordinary way, is the continual inequality they meet with. If we ſuppoſe the wheels to be carried in the air, it is plain that they would not turn, there being nothing to put any part in motion more than another; and the ſame would be the caſe if we could ſuppoſe ice, or any other body, to be ſo ſmooth that it would give as little reſiſtance as air. On common roads, however, the wheels meet with obſtructions at the bottom, which retard that part; and in conſequence of this the upper part moves forward, and a circulating motion immediately begins to take place. By means of this circulatory motion the friction becomes very much leſs than what it would be if the weight were drawn along the ground upon a ſledge, inſomuch that, according to the computation of Dr Helſham, a four-wheeled carriage may be drawn with five times as much eaſe as one that ſlides upon the ſame ſurface as a ſledge.

42
Obſtacles which occur to the motion of carriages.

The ſtructure of wheel-carriages is ſo generally known, that it is needleſs to deſcribe them. In the conſtruction of them, however, there are ſeveral particulars to be obſerved, which may render one method of conſtruction preferable to another, though there may be a general ſimilarity between one carriage and another. In order to aſcertain the moſt proper method for conſtructing them, it will firſt be neceſſary to conſider the obſtacles which occur to their motion. Theſe are,

1. The *vis inertiæ* of matter.—This, though for a conſiderable time ſuppoſed to be a principle of mere *inactivity*, or *reſiſtance* to any change of ſtate from motion to reſt in material bodies, is now almoſt exploded. Mr Anſtice, in a late treatiſe on wheel-carriages, ſuppoſes the philoſophers who maintain the exiſtence of ſuch a principle, to have miſtaken Sir Iſaac Newton and other great men. According to him, they meant no more by the *vis inertiæ* of matter than a mere paſſiveneſs in it, by which it was diſpoſed to abide in that ſtate, either of reſt or motion, in which it originally was: "whereby it alters not its ſtate but in proportion to the quantity of power exerted againſt it. Thus, ſhould a body of any given weight or quantity of matter, moving with a certain degree of velocity, ſtrike another body at reſt of the ſame weight, it would communicate half its motion to that body, and they would move together with the ſame velocity as the firſt; but this proceeds from no principle of the body at reſt to reſiſt motion, it does not deſtroy in the other more than it receives from it; therefore no motion is loſt, it is only divided; and the two after diviſion have a power equal to that of the one before it, with the whole velocity of motion. Indeed when we conſider that the leaſt degree of motion in any body, however ſmall, will communicate ſome degree of it to the largeſt in the univerſe; and that, on the contrary, none but an equal degree of impetus can deprive a body of actual motion, and that immediately oppoſed to it: add to this, that ſince all matter within the reach of our obſervation, and by analogy we have reaſon to think it is in actual and rapid motion, impreſſed on it by its great Creator, and co-exiſtent with it; we may conclude, that if matter do not affect, it is more liable to motion than to reſt."

2. *Friction.* By this is meant the quantity of motion deſtroyed by bodies ſliding over one another, and which is in proportion to the weights laid upon them. See Sect. II. § 8.

Friction depends not only upon the preſſure made on the moving bodies, but on the inequalities on the ſurfaces upon which they move. For as the ſurfaces of even the moſt highly poliſhed bodies have ſome inequalities, whenever two of them are preſſed together, the inequalities of the one muſt enter, and in ſome degree accommodate themſelves, to thoſe of the other; and as the forms of theſe inequalities are of infinite variety, it is impoſſible to give any general deſcription which can exactly anſwer to every one of them.

Plate CCLXXXVII

Mr Anſtice ſuppoſes the varieties only to be of two kinds, which he thinks may not be very diſſimilar to any that occur. 1. Let us imagine two ſliding ſurfaces, when viewed through a microſcope, to preſent ſuch an appearance as is repreſented in fig. 69. in which A is the ſliding body to be moved in the direction CD over the fixed body B. To effect this, it is evident, that either the teeth muſt be violently broken off, or a power applied to them ſufficient to make them ſlide upon each other on the principles of the inclined plane; in which caſe the friction muſt always be in proportion to the weight of the ſlider, and that with which it is loaded, without regard to the length or breadth of the bearing ſurface: for if only one pound reſted upon one tooth, there would be no more but that pound to be lifted. If the pound reſted upon two teeth, there would only be half a pound to be lifted over each, and ſo on to any number; but if we ſuppoſe the teeth to be of ſuch a ſhape, that they cannot act as inclined planes, let them be ever ſo ſtrong, we muſt calculate the friction in a different manner.

Let ſurfaces of this kind be repreſented by fig. 70. In which caſe it is evident, that inſtead of depending on the weight or preſſure only, it will be in proportion to the number and ſtrength of the teeth ſo lock-

ed

ed together; or, in other words, on the length and breadth of the rubbing ſurfaces. On this ſuppoſition the weight of the ſlider will have little or no effect in breaking the teeth, or hindering its being done by the power applied in the longitudinal direction; but if one tooth is to be broken, it will be neceſſary to apply twice that power to break two, thrice the power to break three, &c. Hence it is evidently impoſſible to form any general rule concerning the friction which takes place on this principle. As experience, however, has ſhown that two bricks, or other bodies of that kind, are almoſt as eaſily drawn along a table when placed ſide by ſide, as when laid upon each other, it ſeems probable that ſuch a locking of parts ſeldom occurs; and when it does, the obſtacles are ſoon broken down. Yet it is certain, that ſome ſuch thing muſt take place on all occaſions, otherwiſe the wearing of bodies which rub upon one another could not happen.

From what has been ſaid it muſt appear plain, that if a ſlider be laid upon an horizontal plane, it muſt remain at reſt; though by a very ſmall force, ſuch as is barely ſufficient to overcome the friction, it will be ſet in motion: becauſe, on a plane quite horizontal, the motion of any body does not remove it in the leaſt farther from the point to which it is attracted by the force of gravity. If the plane be inclined to the horizon, then, beſides the power neceſſary to overcome the friction, it will be neceſſary to have one ſufficient alſo to overcome that of gravity, by which it is determined to roll down the plane; the proportion of which is aſcertained under Sect. II. § 4. The difficulty of raiſing great weights in this manner, however, where the aſcent is ſteep, and the ways rough, muſt neceſſarily be ſo great, that ſledges could not be uſed with any advantage, and therefore wheels are indiſpenſable.

The advantage of wheels over ſledges may be further underſtood from the following conſiderations. 1. A ſledge, in ſliding over a plane, ſuffers a friction equivalent to the diſtance through which it moves; but if we apply to it an axle, the circumference of which is ſix inches, and that of the wheels eighteen feet, it is plain, that moving the carriage eighteen feet over the plane, the wheels will make but one revolution; and as there is no ſliding of parts between the plane and the wheels but only a mere change of ſurface, no friction can take place there, the whole being transferred to the nave acting on the axle, ſo that the only ſliding of parts has been betwixt the inſide of the nave and the axle; which, if they fit one another exactly, is no more than ſix inches: and hence it is plain, that the friction muſt be reduced in the proportion of one to thirty-ſix. Another advantage is alſo gained, by having the ſurfaces confined to ſuch a ſmall extent; by which means they may be more eaſily kept ſmooth, and fitted to each other. The only inconvenience is the height of the wheel, which muſt in all caſes be added to that of the carriage itſelf.

It has been a matter of no little conſideration, whether the wheels of a carriage ought to be ſmall or large; and this ſubject Mr Anſtice has treated in a very particular manner. He obſerves, that in the overcoming of ſuch obſtacles as are commonly met with in roads, wheels act as mechanical powers, and therefore the ſize of the wheel muſt be regulated upon the principles of theſe powers. Thus, let the circle O T A G L, fig. 71, repreſent a wheel of four feet diameter, placed on the level P Q, and oppoſed in that line by the obſtacle O, which is ſuppoſed to be 7.03 inches in height; the line in which the carriage is drawn being C T, parallel to the plane P Q. In this caſe the effort applied to the carriage is communicated to the nave of the wheel where it touches the axle. This part, therefore, repreſents the part of the lever to which the power is applied, and is the point C in the figure. As the turning point is that where the wheel touches the obſtacle, that muſt repreſent the fulcrum of the lever; whence that arm of the lever will be repreſented by C O, which may be ſuppoſed a ſpoke of the wheel: and as the upright ſpoke C L is in the line which bears the whole weight from the axle, and in which it is to be lifted; hence that part of the circumference of the wheel which is between the fulcrum and the upright ſpoke bearing on it, muſt repreſent the arm of the lever which is to raiſe the weight. In this caſe neither the weight nor the power act at right angles to their reſpective arms of the lever; ſo that we muſt repreſent their powers by the imaginary lines M O and O N. As the length of O M, therefore, is to that of O N; ſo is the proportion required to the weight to balance it on the obſtacle, when riſing over it; and in this caſe the arms are equal, it is plain that the powers muſt be ſo likewiſe. Every obſtacle, therefore, exceeding this height, which is as 7.03 to 48, will require a power acting parallel to the plane greater than the weight drawn; and every obſtacle whoſe height bears a ſmaller proportion to that of the nave, muſt be overcome by a ſmaller power.

Again, let a wheel of four feet diameter be repreſented by the circle in fig. 72, and ſuppoſed to be moved along the plane PQ, and an obſtacle of twelve inches height be placed before it, the real lever will then be repreſented by the lines L O C; which being reduced to the imaginary ones MON, ſhows that the power is greater than the weight. By the ſame rule, if an obſtacle of three inches be placed in the way of a wheel, as in fig. 73, the power required to move the wheel will be conſiderably leſs than the weight, though it is plain that the proportion of power muſt always be according to the ſize of the wheel, the height of the obſtacle, and the direction in which the carriage is drawn. For inſtance, if the line of traction in fig. 73, be raiſed into the direction C S, the power required to move the carriage over it will be to the real weight as the line C O is to the line ON; and in conſequence of thus altering the direction, we gain as much as the length of the line CO exceeds that of CN.

43 Whether large or ſmall wheels are preferable

This view of the manner in which the wheels of carriages act, will ſerve to elucidate the queſtion, whether large or ſmall wheels are preferable for carriages? Let the circle fig. 74, repreſent a wheel of two feet diameter, and the obſtacle in its way 7.03 inches in height; then will the true lever be repreſented by the lines COL, to be reduced to the imaginary ones MON. In this caſe, the power required to draw the carriage muſt be to its weight as NO is to OM, which is more than double; and thus the advantage of large wheels over ſmall ones is evident. In this, however, as in all other caſes where wheels act as mechanical dical powers, we muſt remember, that the ſame doctrine applies to them as to the powers themſelves when uſed in any other manner, viz. that as much as we gain in power we looſe in time; and therefore, though a wheel of twice the diameter may be raiſed over an obſtacle of any given height with twice the eaſe that would be required for one of once the diameter, yet the large wheel would require twice the time to move over it that the ſmall one does.

Hitherto we have conſidered the carriage as being drawn in a direction parallel, or nearly ſo, to the plane on which the wheels move, which line is ſuppoſed to be horizontal: but the caſe will be different when we ſuppoſe them to move upon an inclined plane; for then, even though the line of traction be parallel to the aſcending plane, and though the wheels act as levers, we ſhall find that the action of the weight will increaſe with the power gained by the increaſe of ſize in the wheels; and conſequently, that the increaſed ſize of the latter will be of no farther uſe than that of diminiſhing the friction, in the ſame manner as is done upon horizontal planes.

To illuſtrate this, ſuppoſe the larger circle in fig. 75. to repreſent a wheel of four feet diameter, and the ſmaller circle a wheel of only two, both of which are made to aſcend the inclined plane LM, by powers applied in the directions GI and ES parallel to the elevation of the plane, which is 45 degrees; it will then be found, that by deſcribing the lever as in the former caſe, though the arm of the lever to which the power is applied be double the length in the large wheel that it is in the ſmall, the other is augmented in the ſame proportion. Neither will the powers be augmented by varying the direction of the line of traction; for while theſe are kept parallel to one another, their relative powers muſt always keep the ſame proportion to one another. The reaſon is obvious, viz. that when wheels of any dimenſion aſcend or deſcend inclined planes of any regular elevation, the fulcrum of the lever contained in the wheels muſt be determined by that part of the wheel which touches the plane, and which muſt always be of a proportionate height both in large and ſmall wheels. It is otherwiſe, however, with the fulcrum marked out by perpendicular or irregular obſtacles upon the plane itſelf; for large wheels will always have the advantage over ſmall wheels when theſe are preſented, for the reaſons already given. Indeed, when the wheel impinges perpendicularly upon an obſtacle as high as the line of traction, it is plain that it cannot be drawn over it by any power whatever, unleſs the direction of the latter be altered.

44
General concluſions concerning the motion of carriages.

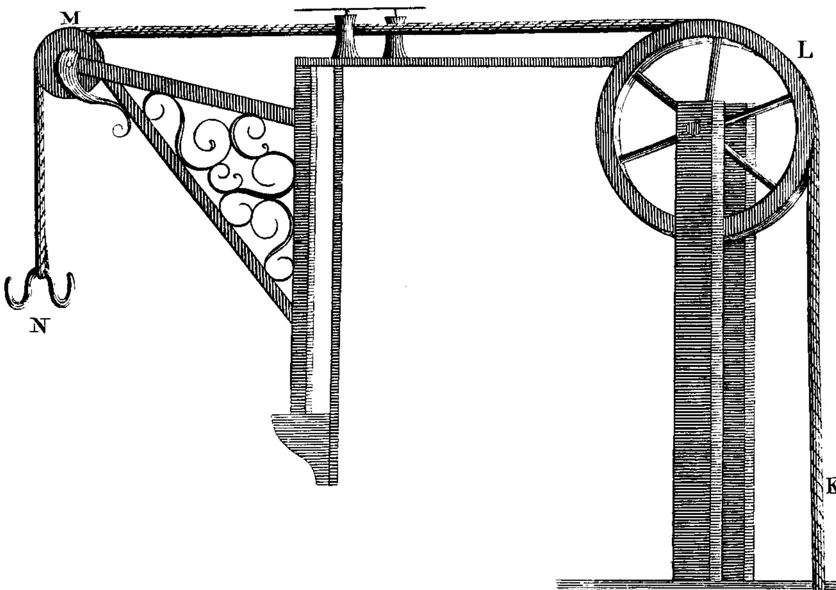
From theſe conſiderations, our author draws the following concluſions: 1. That in a carriage placed upon an horizontal plane, nothing more is required to produce motion than to overcome the friction which takes place between it and the plane. 2. By the application of wheels to a carriage, the friction is leſſened in the proportion of the diameters of the axles and hollow parts of the naves to thoſe of the wheels. 3. In the draught of a carriage without wheels up a regular plain aſcent, the friction muſt not only be overcome, but there is a power likewiſe to be applied ſufficient to lift ſuch a proportion of the weight of the carriage as the perpendicular part of the aſcending plane bears to that portion of the plane. 4. If wheels of any ſize be applied to the carriage in ſuch circumſtances, they have only the advantage of leſſening the friction; for though they really act as levers, yet as each arm of the lever is lengthened in proportion to the increaſe of ſize in the wheels, the power can be no farther augmented than as the aſcent may act as a mechanical power for raiſing up the wheels, carriage, &c. to the top. 5. Large wheels have the advantage over ſmall ones in overcoming obſtacles, becauſe they act as levers in proportion to their various ſizes. 6. The line of traction, or that in the direction of which the carriage is drawn, ſhould always, if poſſible, be parallel to that in which the plane lies; for when this is the caſe, the arm of the lever to which the power is applied will bear the longeſt proportion poſſible to the other. This always takes place when the line of traction is perpendicular to that ſpoke of the wheel which points to the obſtacle. As it may not always be poſſible, however, to alter the direction of the line of traction to this poſition, it will be moſt proper to fix upon ſome medium betwixt that which commonly occurs and that which requires the greateſt exertion to overcome the obſtacle; that is, betwixt a level line and one riſing perpendicular to the ſpoke of the wheel which points to the obſtacle it is likely to meet with. The greater attention ought to be paid to this laſt, that all wheels, but eſpecially ſmall ones, are liable to ſink into the ground over which they paſs, and thus produce a conſtant obſtacle to their own progreſs. The line of traction, it muſt alſo be obſerved, is not an imaginary one drawn from that part of the animal to which the traces or chains are attached to the axle of the wheel, but the real direction of the traces to whatever part of the carriage they are attached; for the effort will be inſtantly communicated in the ſame direction from one part of the carriage to all the reſt, by reaſon of the whole being faſtened together and in one piece.

Hitherto we have conſidered the whole weight of the carriages as bearing perpendicularly againſt the axles of the wheels: but as this cannot be done in chairs, carts, and other carriages having only two wheels, it will be neceſſary to have their centres, or tranſverſe lines of gravity, as near to the ground as poſſible. To underſtand this, it muſt be premiſed, that the centre of gravity is that point of any body which if ſuſpended will keep all the parts of the body at reſt, let the body be placed in any ſituation we pleaſe. Thus the centre of gravity in a wheel or circle is the centre of the circumference, provided the ſubſtance of it be equably ponderous throughout. In like manner, the real centre of a globe coincides with the centre of gravity, provided the matter of which it is compoſed be equably ponderous. In a ſquare, whether ſuperficial or ſolid, the centre of gravity will be a point equally diſtant from all its ſides; ſo that if the ſubſtance be equably heavy, it will be impoſſible to turn it into any poſition in which there will not be as much matter upon one ſide of the centre as upon the other: and in like manner, every figure, however irregular, has ſome point round which, if it be turned, as much matter will always be upon one ſide as on the other.

If now any body be ſupported by a tranſverſe line paſſing not through the centre of gravity itſelf, but

MECHANICS

Fig. 59



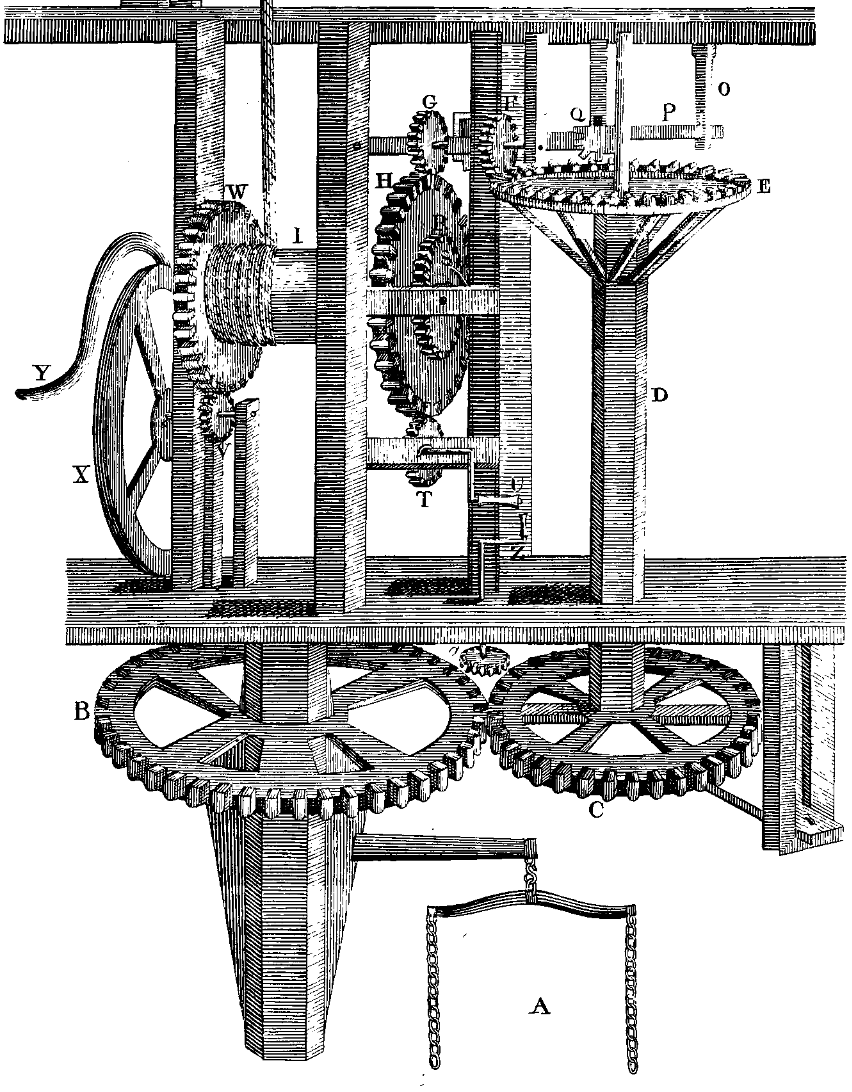


Fig. 60

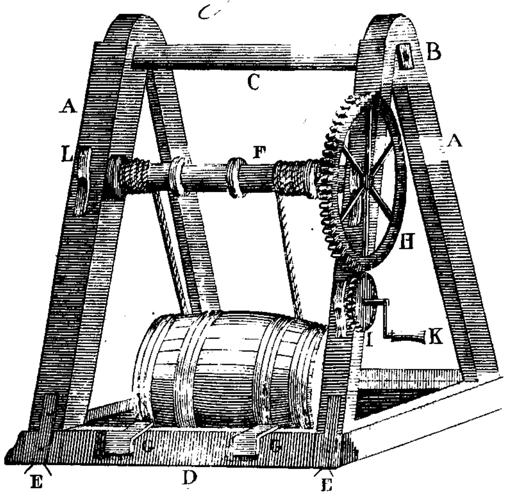


Fig. 61

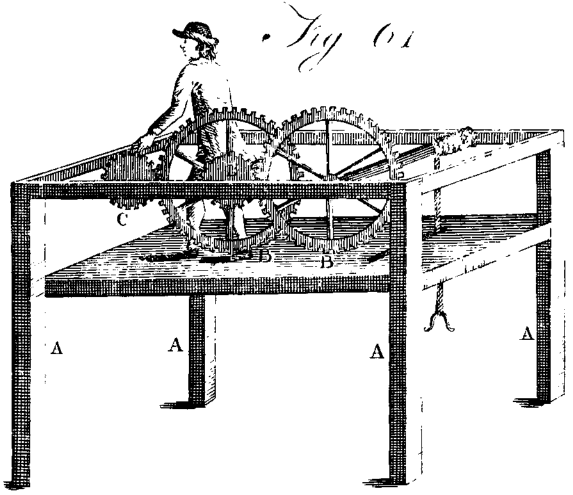
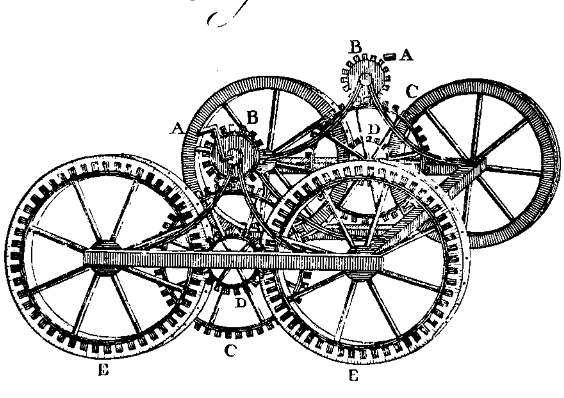


Fig. 62



S. Allardice sc.

either above or below it, the body can only be kept in equipoiſe while that line remains directly above or below the point; for if the body is moved forwards, as in two-wheeled carriages moving downhill, a greater part of the weight will be thrown forwards over the line of ſuſpenſion than what remains behind it; and conſequently this ſuperfluous part muſt be borne by the animal which draws it. In aſcending any height, juſt the reverſe takes place; for thus a portion of the weight is thrown backwards, and will tend to lift up the animal altogether. The conſequence of this is, not only that the creature muſt proceed with great pain, but that the friction on the nave and axle will be augmented by laying upon them a part of the animal's weight alſo. If the body be ſuſpended above the centre of gravity, the effect, though the ſame in the main, will be reverſed in the aſcent and deſcent of a hill, as long as the body is firmly attached to the ſhafts; but ſhould the whole weight be ſuſpended under the axle, independent of the ſhafts altogether, then it will always, whether aſcending, deſcending, or moving horizontally, have the ſame effect as if hung directly by it.

45
Of ſuſpending carriages above or below the centre of gravity.

Our author next proceeds to treat of a generally received opinion, that the diſadvantages attending carriages ſuſpended either above or below the centre of gravity are augmented by the height of the wheels. The reaſon given for this opinion is, that the hinder part of the load in aſcending an hill, being thrown back, will overhang that part of a large wheel which touches the plane, much more than when a ſmaller wheel is uſed. Mr Anſtice, however, obſerves, that all the diſadvantage, in either caſe, is expreſſed by the weight which, from its action upon the axle tends to lift the animal, which muſt always be the ſame whether the wheels are high or low. Thus, in fig. 76. let a carriage be repreſented with two wheels of four feet diameter, aſcending a plane of 35° elevation from the level LE. Let fig. 77. repreſent a carriage exactly in the ſame circumſtances with the former, only that the wheels are ſix feet in diameter. Let C be the centre of gravity, and SP the line of gravity parallel to the central line AR, the line of ſupport or ſuſpenſion; in each of theſe the body is thrown ſo far back by its poſition, that the ſpace GS and AR is taken from before the line of gravity, and added to the part behind it. Hence a certain part of the animal's weight muſt be exerted upon the ſhafts, in order to balance that of the carriage, which is thus thrown back, and which, as is evident from the figures, muſt be the ſame in both carriages, though the wheels of the one ſo much exceed thoſe of the other in ſize, and the point T, where the wheel touches the plane, is much farther from the line of ſuſpenſion in the large wheel than in the ſmall one.

To remedy the inconvenience which muſt ariſe from placing the centre of gravity in the carriage low enough with reſpect to the wheels, it will be beſt to apply three or four wheels, placing them in ſuch a manner that the line of gravity may always fall between the wheels, in whatever ſituation the carriage may probably be placed. Thus if the body A, fig. 78, be placed on four wheels, the axles of which are at B and C, it will be entirely ſupported between them, though more by C than B, even though the carriage ſhould be aſcending an hill as ſteep as HI, viz. 50 degrees, which cannot ever happen in practice. Even in this caſe the animal would have no occaſion to make exertions for preſerving the balance of the carriage, though, had it been ſupported only by the axles of two wheels at S, far the greater part of the weight of the carriage would have been thrown behind, and the equilibrium could not have been preſerved without the greateſt difficulty. Hence it is plain, that the greater the diſtance betwixt the axles of three or four wheels applied to a carriage, the leſs liable will it be to have the line of gravity thrown out of its proper direction: but as this diſtance greatly augments the difficulty in turning a carriage, ſome medium is to be obſerved in this as well as other things.

46
Of preventing a carriage from being overturned.

What has been juſt now obſerved with regard to the preſerving the balance of a carriage longitudinally, applies equally to the preventing it from being overturned laterally upon uneven roads, or ſuch as have one ſide much higher than the other. In order to this, we muſt take care to keep the line of gravity ſo far within the body of the carriage that it cannot be thrown out of it by any ordinary declivity of the road upon one ſide more than another. In the preſent caſe, however, as the wheels are not moveable on an axle in a lateral direction, we muſt conſider the points of ſuſpenſion to be thoſe where the wheels touch the ground. Thus, let fig. 79. repreſent the croſs ſection of a carriage moving upon two wheels; let C be its centre of gravity: it is plain, that in the poſition there repreſented, each of the points A and B ſuſtains an equal ſhare of the weight, and muſt do ſo as long as the carriage moves upon level ground: but if it be drawn along a road one ſide of which is higher than the other, ſuch as repreſented fig. 80. then the centre of gravity, and conſequently the whole weight of the carriage, will bear upon the point of the wheel B, with this additional inconvenience, that the preſſure does not lie perpendicularly but ſomewhat obliquely, by which the wheel is in great danger of being broken. To avoid inconveniences of this kind, the points of bearing upon the wheels are removed to a greater diſtance than the exact perpendicular, and this is called *diſhing* the wheels; the good effects of which are evident from the figure. The wheels are diſhed by inſerting the ſpokes into the naves in ſuch a manner that they may decline every way from the carriage. Some diſadvantage, however, attends this contrivance, for the carriage thus takes up more room upon the road, which makes it more unmanageable; and when it moves upon plain ground, the ſpokes not only do not bear perpendicularly, by which means their ſtrength is leſſened, but the friction upon the nave and axle is made unequal, and the more ſo the more that the wheels are diſhed. To obviate theſe inconveniences, ſome have bent downwards the ends of the axles; but thus the good effects of the diſh is entirely loſt, for the wheels are thereby thrown erect, and the breadth of the diſh doubly increaſed on the upper part of the carriage.

The practice of bending forward the ends of the axle is ſtill worſe; for thus the wheels are thrown out of that parallel direction which they ſhould always preſerve on the ground, and likewiſe increaſes the friction both on the ſhoulders of the axles, and likewiſe on the ground; for the wheels, by rolling in this poſition, would ſoon come together if not prevented by the ſhoulders of the axles; whence in every revolution they muſt rub with conſiderable force upon the ground.

47
How the power of wheels may be augmented.

The power of wheels can only be augmented in two ways. 1. By increaſing the length of that arm of the lever to which the power is applied; and, 2. By diminiſhing the friction betwixt the nave and axle. The former is only a temporay expedient in caſe of any obſtacle which cannot be ſurmounted in the ordinary way. It is accompliſhed, by transferring the action of the animal's power from the centre to the upper part of the circumference of the wheel: thus the power of the lever will be nearly doubled, as is ſhown from fig. 71. for if the power be applied to the wheel at A, then the arm of the lever would be repreſented by the dotted line AO inſtead of CO; and the former being nearly twice as long as the latter, their powers muſt be in the ſame proportion. It is evident, however, that this mode of applying the animal's power can only be uſeful in any ſudden emergency; for were we to attempt to reduce it into practice by winding a rope or chain about the circumference of the wheel, the animal muſt move twice as faſt as the carriage. See this alſo exemplified in Plate cclxxxv. fig. 58, where the moving power is repreſented by the weight P; the wheel EF turning between two toothed planes AB and CD. Here it is evident, that while one of the ſmall diviſions *ca*, *ae*, &c. moves forward its own length, the plane A muſt do the ſame, while the centre, by the motion of which only that of the wheel can be meaſured, moves but through half the ſpace.

48
Of friction-wheels.

Plate cclxxxvii.

2. With reſpect to friction-wheels or rollers, the caſe is different; and we may apply theſe in as great numbers, and in as great a variety of ways as we pleaſe, without fear of inconvenience. The beſt method of applying them, according to Mr Anſtice, is to have the wheels and axle fixed to one another, ſo that both may turn together. Two friction wheels a little overlapping each other, muſt then be fixed on each ſide of the body of the carriage, ſo that it may bear on the axle in the interſection of the wheels, as is repreſented in fig. 81. Here ABCD repreſents the body of the carriage, the large circle one of the wheels fixed to the axle E. The circumference of each of the friction-wheels F and G is ſuppoſed to be three feet, and that of their axles three inches. As the large wheel then revolves by the motion of the carriage, and thus transfers the friction from its circumference to its axle; ſo the friction of the axle itſelf is now transferred from the circumference of the friction-wheels to their axles. Every revolution of the great wheel, therefore, during which it paſſes over 18 feet of ground by means of the motion of the axle, puts the leſſer wheels round one ſixth part of their circle; and conſequently their axles are moved through the ſame part of their circumference, the friction being thus reduced to that upon this ſmall part; which being no more than half an inch, becomes 432 times leſs than it would have been on the large wheel without any motion on an axle, and 12 times leſs by means of the friction-wheels than without them. The axles on both ſides indeed are in motion, but the calculation muſt be made as if only one moved; for the greater number of wheels there are, the more will the friction be divided among them.

49
Mr Gamett's method of deſtroying friction.

An objection of conſiderable weight ariſes to this method of fixing the wheels and axles together, that thus the wheels are prevented from moving with different velocities as they ought to do, when the carriage moves out of a right line; but this may be obviated by leaving the friction-wheels looſe upon their axles, by which means they will be at liberty to move with different velocities, at the ſame time that they will have the advantages of friction-wheels always as to one wheel of the carriage, and generally as to both.—The whole contrivance, however, ſeems likely to be entirely ſuperſeded by the following one of Mr Gamett of Briſtol, who has obtained a patent for it. The general principle on which he proceeds is this. Between the axle and nave a hollow ſpace is left to be filled up by ſolid equal rollers nearly touching each other. Theſe are furniſhed with axles inſerted into a circular ring at each end, by which their relative diſtances are preſerved; and they are kept parallel by means of wires faſtened to the rings between the rollers, and which are rivetted to them.

Plate cclxxxviii.

To underſtand the effect of this machinery we muſt conſider, that if, when plane ſurfaces move with a roller between them, if the under one be fixed, the upper plane will put the rollers forward but with half the quantity of its own motion. This is owing to the reaction of the ſtationary plane, which cauſes the roller to move backward upon itſelf as much as the other cauſes it to move forward upon itſelf. Thus, let CD, fig. 82. be a fixed ſurface, and AB a moveable one, with a roller E between them; if B be moved forward to G, it will cauſe the roller to move to F, which is but half the diſtance that AB has moved; becauſe it has rolled in a retrograde direction as far againſt the ſurface BA as it has gone forward upon the other. This is entirely owing to the reſiſtance it meets with from CD; for if it did not touch that ſurface, but was attached by any other means to AB, it would be carried along with it through the whole ſpace without any rolling motion. Hence it is clear, that if a roller be placed between the axle and nave of a wheel, and the latter be turned round, the roller will move with a retrograde motion upon the axle; and in order to carry it quite round, the nave muſt be turned as much beyond a whole revolution as is equal on its inner circumference to the whole circumference of the axle. To exemplify this, let ABCD, fig. 83. repreſent the nave of the wheel E, the inner circumference of which is 18 inches, and the axle ſo ſmall that it may be conſidered as a point. Let F and G be two rollers cloſely fitted between them: if then the wheel be turned round, the rollers will alſo be carried along with it round the point which we conſider as an axle; for there can neither be rolling nor friction againſt a mere point. But if the axle be of any ſenſible ſize, for inſtance one inch circumference, then muſt each roller move round by the motion of the nave againſt it, and the reſiſtance of the angle on the oppoſite ſide. But in order to do this, it muſt roll in a retrograde direction upon the nave, and conſequently the latter muſt go as far beyond a revolution as is equal to the circumference of the axle upon it, before the roller can go once round the axle, which in this caſe is by one

Fig. 63.

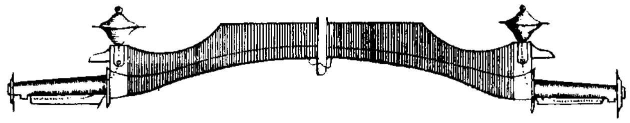


Fig. 64.

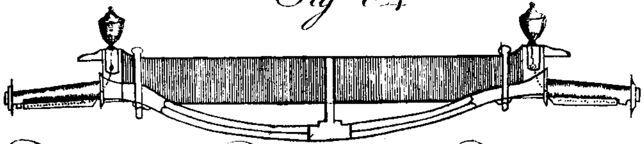
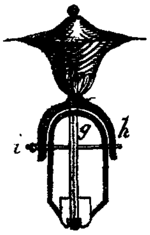


Fig. 67.



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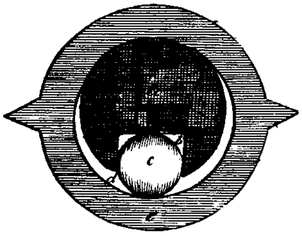


Fig. 66.

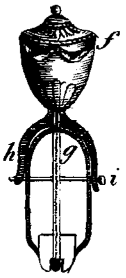


Fig. 68.

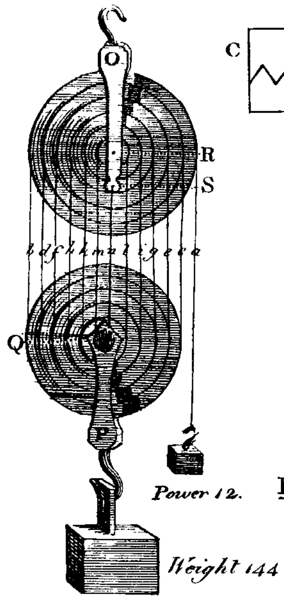
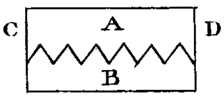


Fig. 69.



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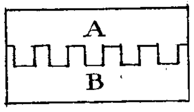


Fig. 78.

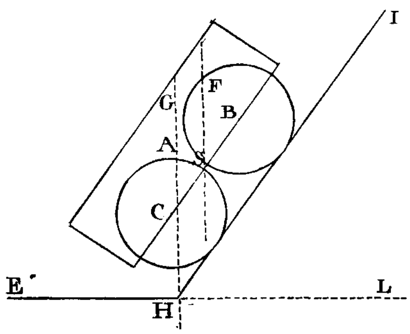


Fig. 77.

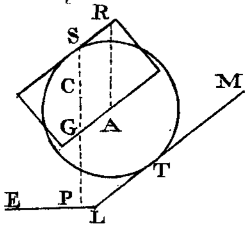


Fig. 72.

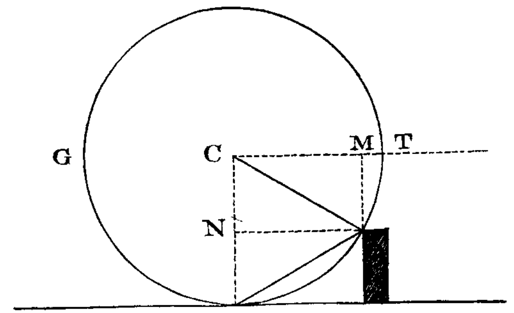


Fig. 71.

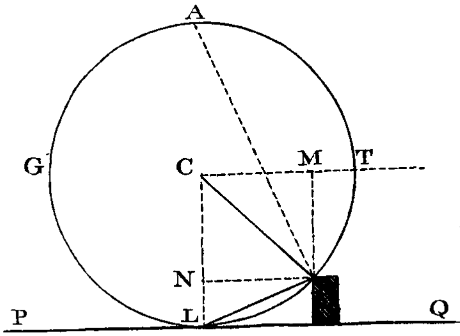


Fig. 76.

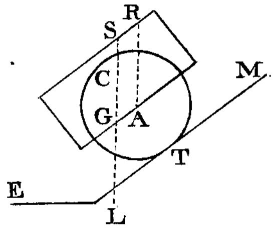


Fig. 75.

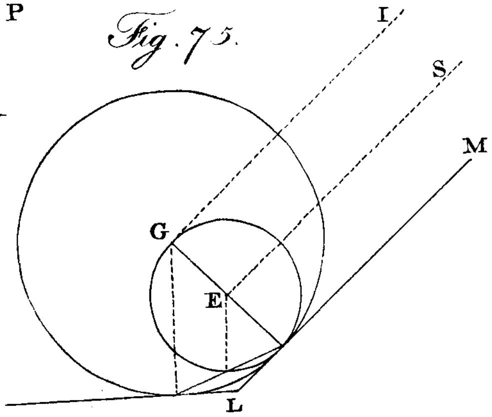


Fig. 79.

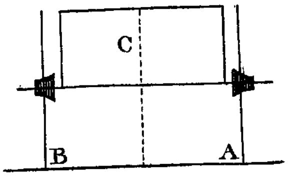


Fig. 73.

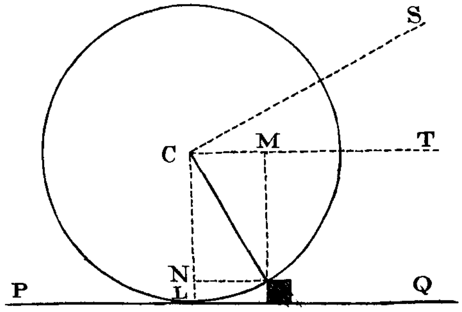


Fig. 81.

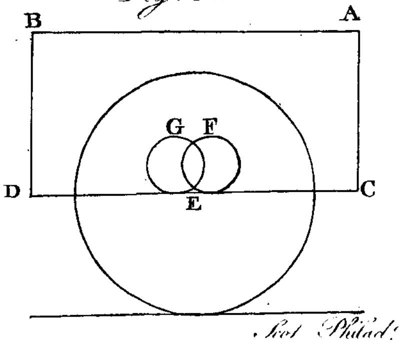


Fig. 80.

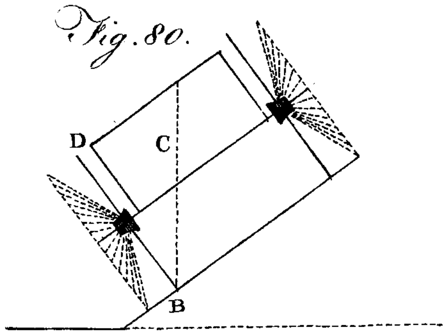
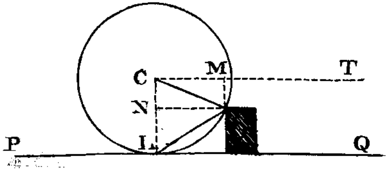


Fig. 74.



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Wheel-carriages.

one 18th part of the circumference. Should the circumference of the axle be nine inches, and that of the inner part of the nave remain as before, the wheel muſt perform one revolution and an half before the roller could be moved once round, and ſo on in the ſame proportion: but as the circumference of an axle muſt always be leſs than the inner part of a nave turning upon it with rollers between them, it never can amount to two revolutions of the wheel round the axle, however nearly it may approach to it; for no ſegment of a circle can ever be a ſtraight line.

It will now be apparent, that if ſeveral rollers be placed all round between the nave and axle, whichever way the wheel be turned there cannot be any real friction, but merely a rolling of the rollers. If likewiſe theſe rollers be all of one ſize, and very nicely fitted to the cavity, they will keep their places without ſhifting, and very effectually anſwer the purpoſe of deſtroying friction. As ſuch rollers, however, were very liable to be diſplaced by accident, the uſe of them was neglected, till Mr Gamett ſuggeſted the improvement already mentioned, and which is repreſented in fig. 84. Here ABCD repreſents a piece of metal to be inſerted into the nave of a wheel, of which E is the axle, and 1, 1 1, &c. rollers of metal having axes inſerted into the braſen circle which paſſes thro' their centres; and both circles being rivetted together by means of bolts paſſing between the rollers from one ſide of the nave to the other; and thus they are always kept ſeparate and parallel. By this method, indeed, ſome friction unavoidably takes place betwixt the axles of the rollers and their ſockets in the braſs-rings; but as the quantity of friction depends principally on the force by which the rubbing ſurfaces are preſſed upon each other, and as in this caſe there is but the ſlight preſſure occaſioned by thoſe accidental circumſtances which would bring the rollers together, the friction muſt be too trifling to be noticed.

Thus far with regard to wheel-carriages in general. We muſt now make ſome remarks on the methods of drawing them, and the conſtruction of particular carriages.—Men, by reaſon of their upright form, are by no means fitted for horizontal draughts; but animals who go upon all fours are remarkably ſo. In Britain horſes are commoly made uſe of; but mules, oxen, ſheep, and dogs, in other parts of the world. In all animals, however, the capacity for drawing a load depends upon their weight as well as their abſolute ſtrength. Thus it may happen that a very heavy horſe will draw a load, which a lighter though ſtronger one could not move; and this will always happen, when the weaker horſe exceeds the other in weight more than he is exceeded by him in ſtrength. It is well known that the weight, as far as it goes, reacts upon the horſe, and pulls him back as much as he pulls it forward, until the exertions of the muſcles of the animal reſiſted, by the ſolid ground, overcome the reſiſtance of the load upon the moveable wheels, and it goes forward in proportion to the exceſs of the one power over the other. If the horſe were put upon a moveable plane, and attempted to draw a load upon the ſolid ground, inſtead of pulling it forward he would pull himſelf back.—The horſe has two ſources of power in drawing a load, viz. his ſtrength and weight. The former is the ſource of velocity; and as we find the actual power of any inanimate body in motion by multiplying the velocity into its quantity of matter, ſo do we find the power of a horſe to draw a load, by conſidering his weight as well as abſolute ſtrength. There are even many inſtances in common practice, where it is uſeful to increaſe the weight of an horſe or other animal; and therefore when horſes are employed to draw mills, it is uſual to put a ſmall load upon their backs in order to increaſe their abſolute momentum. Where the animals are equal in ſtrength and momentum, however, the only difference that can take place in the weights they draw muſt ariſe from the convenience or inconvenience of the carriages to which they are yoked, or of the roads upon which they walk. A load breaſt-high is much more eaſily drawn than one which is dragged along the ground, becauſe the power of the animal is then exerted directly againſt it; and this holds good whether the horſes go up or down hill. In deſcending, indeed, as the load is then higher with regard to the horſe than when it is on a plane, he will conſequently pull it with the greater force; but in this caſe, its own gravity conſpires with the draught, and will likewiſe help the load to deſcend; ſo that in this caſe the animal has an opportunity of exerting his greateſt power when there is the leaſt neceſſity, nay, when it is often inconvenient.

In all carriages with four wheels the two fore ones are made of a much ſmaller ſize than the hind ones, both for the ſake of turning more eaſily, and likewiſe that there may be no danger of cutting the braces; but were both the fore and hind wheels to be of the ſame height, the carriage would be drawn with much greater eaſe. It is imagined indeed by the drivers of carriages, that the high hind wheels puſh on the fore-wheels: but this is evidently abſurd; for the fore-wheels muſt turn as many times round oftener than the large ones as the latter exceed them in ſize. Thus, if we ſuppoſe the circumference of the large wheels to be 18 feet, and that of the ſmall ones only *ſix*, it is evident that the latter muſt turn round three times for once that the large ones turn round. Suppoſing the carriage therefore to be loaded equally on both axles, it is plain that by the greater friction upon the fore-axle than the other, it muſt wear out much ſooner, and that as much as the fore-wheels are ſmaller than the hind ones. But it is the univerſal practice of thoſe converſant in loading and driving carriages, to put a much greater load upon the fore than the back axle. Thus the friction not only becomes greateſt where it ought to be leaſt, but the ſmall wheels muſt neceſſarily ſink deeper into the ground than the large ones, which they are at any rate inclined to do from their ſize. The only danger in laying the greateſt load upon the hind axle is, when the carriage goes up a very ſteep aſcent; but in the few caſes in which this may happen, a ſmall temporary weight laid upon the pole betwixt the horſes would prevent all danger of overſetting.

To confirm theſe reaſonings by experiment, let a ſmall model of a waggon be made, with its fore-wheels $2\frac{1}{2}$ inches in diameter, and its hind-wheels $4\frac{1}{2}$; the whole model weighing about 20 ounces. Let this little carriage be loaded any how with weights, and have a ſmall cord tied to each of its ends, equally high from the ground it reſts upon ; and let it be drawn along a horizontal board, firſt by a weight in a ſcale hung to the cord at the fore-part ; the cord going over a pulley at the end of the board to facilitate the draught, and the weight juſt ſufficient to draw it along. Then turn the carriage, and hang the ſcale and weight to the hind-cord, and it will be found to move along with the ſame velocity as at firſt : which ſhows that the power required to draw the carriage is all the ſame, whether the great or ſmall wheels are foremoſt ; and therefore the great wheels do not help in the leaſt to puſh on the ſmall wheels in the road.

Hang the ſcale to the fore-cord, and place the fore-wheels (which are the ſmall ones) in two holes, cut three eight parts of an inch deep in the board ; then put a weight of 32 ounces into the carriage over the fore-axle, and an equal weight over the hind-one : this done, put 44 ounces into the ſcale, which will be juſt ſufficient to draw out the fore-wheels: but if this weight be taken out of the ſcale, and one of 16 ounces put into its place, if the hind-wheels are placed in the holes, the 16 ounce weight will draw them out ; which is little more than a third part of what was neceſſary to draw out the fore-wheels. This ſhows, that the larger the wheels are, the leſs power will draw the carriage, eſpecially on rough ground.

Put 64 ounces over the axle of the hind-wheels, and 32 over the axle of the fore-ones, in the carriage ; and place the fore-wheels in the holes : then put 38 ounces into the ſcale, which will juſt draw out the fore-wheels ; and when the hind-ones come to the hole, they will find but very little reſiſtance, becauſe they ſink but a little way into it.

But ſhift the weights in the carriage, by putting the 32 ounces upon the hind-axle, and the 64 ounces upon the fore-one ; and place the fore-wheels in the holes : then, if 76 ounces be put into the ſcale, it will be found no more than ſufficient to draw out theſe wheels ; which is double the power required to draw them out when the lighter part of the load was put upon them ; which is a plain demonſtration of the abſurdity of putting the heavieſt part of the load in the fore-part of the waggon.

Every one knows what an outcry was made by the generality, if not the whole body, of the carriers, againſt the broad-wheel act in Britain ; and how hard it was to perſuade them to comply with it, even though the government allowed them to draw with more horſes, and carry greater loads than uſual. Their principal objection was, that as a broad wheel muſt touch the ground in a great many more points than a narrow wheel, the friction muſt of courſe be juſt ſo much the greater ; and conſequently there muſt be ſo many more horſes than uſual to draw the waggon. It is believed that the majority of people were of the ſame opinion ; not conſidering, that if the whole weight of the waggon and load in it bears upon a great many points, each ſuſtains a proportionably leſs degree of weight and friction, than when it bears only upon a few points : ſo that what is wanting in one is made up in the other ; and therefore will be juſt equal under equal degrees of weight, as may be ſhown by the following plain and eaſy experiment.

Let one end of a piece of pack-thread be faſtened to a brick, and the other end to a common ſcale for holding weights : then, having laid the brick edgewiſe on a table, and let the ſcale hang under the edge of the table, put as much weight into the ſcale as will juſt draw the brick along the table. Then taking back the brick to its former place, lay it flat on the table, and leave it to be acted upon by the ſame weight in the ſcale as before, which will draw it along with the ſame eaſe as when it lay upon its edge. In the former caſe, the brick may be conſidered as a narrow wheel on the ground ; and in the latter, as a broad wheel. And ſince the brick is drawn along with equal eaſe, whether its broad ſide or narrow edge touches the table, it ſhows that a broad wheel might be drawn along the ground with the ſame eaſe as a narrow one (ſuppoſing them equally heavy), even though they ſhould drag, and not roll, as they go along.

50 Of broad and narrow wheels.

As narrow wheels are conſtantly ſinking into the road, they not only prove very deſtructive to the highways over which the carriages move, but by reaſon of this very ſinking, they muſt be accounted as going continually up hill in ſome degree, even when drawn upon plain ground. Theſe inconveniences are obviated by the uſe of broad wheels ; and indeed the utility of theſe is ſo obvious, that it ſeems ſurpriſing how the uſe of narrow wheels is on any occaſion permitted by the legiſlature. The wheels ordinarily uſed for waggons in Britain are nine inches broad ; but of late a practice has been introduced of uſing rollers 16 inches broad ; by which the inconveniences of the narrow wheels are removed, and the greateſt weights way be drawn over the very worſt roads, not only without making them worſe, but greatly to their improvement. It has been objected, that broad wheels ſoon accumulate in clayey roads ſo much matter that it would ſoon equal an ordinary load ; but, not to mention that ſuch roads ought to have no exiſtence in a country where ſuch ſums are annually paid for their reparation, it is evident, that paſſing heavy rollers over them is the only method to give that firmneſs to clay which is neceſſary for its ſupporting the animals who walk over it ; and indeed many of the roads in Britain, by reaſon of the continual poaching by wheels and feet of horſes, &c. become throughout a great part of the year almoſt impaſſable by people on foot. The Britiſh legiſlature appear to be very ſenſible of the advantage derived from theſe rollers, and accordingly allow ſuch carriages as are furniſhed with them to go toll-free.

51 Mr Edgeworth's experiments on carriages.

In the tranſactions of the Royal Iriſh Academy for 1788, we meet with ſome curious obſervations on the ſubject of wheel-carriages, by Mr Lovell Edgeworth. This gentleman informs us, that he was preſent in London in 1773, at a ſet of experiments tried in order to determine the comparative advantages of low and high wheels. The apparatus for theſe experiments were conſtructed with the greateſt accuracy. The carriages themſelves were made by the beſt workmen in London, and they were drawn along a ſmooth table by ſilk ſtrings of ſmall diameters put over a pulley nicely conſtructed, and fitted up in ſuch a manner as to have ſcarce any friction. On applying a weight to the end of the ſtring which paſſed over the pulley, little difference appeared in the velocities with which the carriages paſſed along the table, whether the wheels were high or low ; but what appeared ſurpriſing was, that when obſtacles were put in in their way, ſometimes the high and ſometimes the low wheels had the advantage, according to the different ſhapes and ſizes of the obſtacles. “It appears at firſt view (ſays Mr Lovell), that the force which drew theſe carriages was employed only in overcoming the friction of the axle-tree, or in lifting the weight over the obſtacle. But I ſuſpected at the time, and have ſince been convinced, that an obſtruction of another ſort exiſted more conſiderable than either of theſe which I have mentioned, and which has not to my knowledge been taken notice of by any writer upon mechanics.”

52
Suppoſed proof of the *vis inertiæ*, independent of gravity.

This obſtruction is no other than the *vis inertiæ* of matter, which has ſo much engaged the attention of philoſophers, and the non-entity of which, in diſtinction from the power of gravity, ſeems now to be pretty generally admitted. The argument uſed for its exiſtence by Mr Edgeworth is as follows: “After a carriage has been once ſet in motion upon a ſmooth road with any given velocity, its motion, ſo long as that velocity is continued, is neither retarded nor promoted by the *vis inertiæ*; but whenever it paſſes over any height, not only the weight of the carriage muſt be lifted up, but the *vis inertiæ* of that weight muſt be overcome in a new direction; and as much velocity muſt be communicated to it in that new direction as will enable it to riſe to the height of the obſtacle while it paſſes over its baſe. When an obſtacle is of ſuch a ſize and ſhape that a wheel of ſix feet diameter muſt ſtrike the top of it at once, and not roll from the bottom upwards, and when its ſhape will permit a ſmaller wheel to touch it during its whole aſcent, as there is more time allowed for overcoming the *vis inertiæ* of its weight in the latter caſe than in the former, the ſmaller wheel may be drawn forward by a leſs power than the larger, notwithſtanding the advantage of the lever, which is in favour of the larger wheel.”

To determine this, our author made uſe of an inclined plane five or ſix feet long and one foot high, placed on a ſmooth horizontal floor. He then aſſumed the diſtance to which the carriage was driven on the floor by the velocity acquired in deſcending the plane, as a meaſure of the force with which it could overcome any obſtacle placed in its way; and conſequently the diminution of the diſtance was the meaſure of the reſiſtance itſelf. Not ſatisfied with this apparatus, however, he ſcrewed a circle of iron three feet three inches in diameter upon a ſolid floor. In the center of this circle he erected an upright axis or roller upon two pivots, one reſting in a ſocket of braſs upon the floor, the other in a bridge raiſed acroſs the machine. Around the axis was wound a ſmall ſilk cord, with a ſcale and weights faſtened to it, which paſſed over a pulley into an adjoining ſtair-caſe, and turned the axis with a determined velocity. An horizontal arm of wood extended from the axis to the circumference of the inner circle, and to the extremity of the arm was faſtened a piece of ſteel in form of the axle-tree of a carriage, having a wheel upon it, which by the motion of the axis was carried round upon its edge like the ſtone of a tanner's mill. The arm was furniſhed with an hinge, by means of which the wheel could riſe up and paſs over any obſtacle which ſtood in its way. Above this was another arm, having on its extremity a tin vane, which by its reſiſtance to the air regulated the motion of the machine. On putting weights into the ſcale, it was found that eight or ten turns were neceſſary to give the wheel an uniform velocity, which was preſerved in all the experiments, any reſiſtance thrown in the way being overcome by an addition of weight, and conſequently this addition being always an accurate meaſure of the reſiſtance.

On loading the wheel ſo as to weigh about four pounds, it acquired a velocity of ten feet in a ſecond by nearly five pounds and an half; but on placing in its way an obſtacle only a quarter of an inch high, ſix pounds and an half were required to cauſe the wheel paſs over it. Two ſuch obſtacles required fourteen and an half pounds; but on ſubſtituting two obſtacles of the ſame height, but making an inclined plane three quarters of an inch long, it required only two pounds to overcome their reſiſtance. “The difference therefore (ſays he) between two and fourteen muſt be attributed to the *vis inertiæ*; for the velocities of the carriage and the heights of the obſtacles remaining the ſame, the only difference that exiſts is, that in the one caſe the wheel has much more time to ſurmount the obſtacle than in the other, and conſequently had much leſs *vis inertiæ*.”

On this piece of reaſoning, however, it is impoſſible to avoid making the following remark, *viz.* that nothing happens but what ought to do ſo upon the common principles of mechanics. One obſtacle, when upright, required ſix pounds and an half to overcome it; but when an inclined plane three times the length was added to it, it ought then to have been overcome by a third part of the power, that is, by ſomething more than two pounds; and the reaſon why ſomething leſs than the third part was required, ſeems to have been the advantage the wheel had by acting as a lever; as has been already obſerved on the principles of Mr Anſtice. There is not therefore the leaſt occaſion to apply to a *vis inertiæ*, or any obſcure principle, for a ſolution of what may ſo eaſily be ſolved upon the common principles of mechanics and gravity.

53
Uſe of ſprings in carriages.

Mr Edgeworth concludes his obſervations with ſome remarks on the uſe of ſprings, which are found greatly to facilitate the draught of carriages. “Whatever (ſays he) permits the load to riſe gradually over an obſtacle without obſtructing the velocity of the carriage, will tend to facilitate its draught; and the application of ſprings has this effect to a very conſiderable degree: the ſame weight of four pounds being drawn over the ſame obſtacles, when ſprings were put between the load and the carriage, by four pounds inſtead of 14. This remarkable difference points out the great advantages of ſprings in rough roads; an advantage which might be obtained for heavy waggons, as well as for other carriages, by a judicious application of the ſame means.

It appears from the Memoirs of the French academy, that the idea of applying ſprings to carriages had occurred to M. Thomas in the year 1703; who has given a drawing of a carriage conſtructed upon this principle many years before it was attempted to be put in execution. So little expectation had he of ſucceſs, that he expreſsly mentions it as a theory which could not be reduced to practice; he had, however, no notion of applying ſprings to facilitate the draught, but

but merely for the convenience of the rider; and I apprehend that it is not at preſent commonly imagined that ſprings are advantageous for this purpoſe; nor would it at firſt ſight appear credible, that, upon a rough paved road, ſuch as are common in Cheſhire and other parts of England, a pair of horſes could draw a carriage mounted upon ſprings with greater eaſe and expedition than four could draw the ſame carriage if the ſprings and braces were removed, and the carriage bolted faſt down to the perch."

54
On high and low carriages.

Mr Lovell made alſo ſome experiments with high and low, long and ſhort, carriages, in order to determine which was the moſt advantageous, but could not recollect the particular reſults of each experiment. He was, however, aſſured, that the preference lately given in England to high carriages is ill-founded; and that, though in ſmooth roads, the height of the carriage is a matter of indifference, yet in rough roads it is very diſadvantageous. The length of carriages alſo, if their weight be not increaſed, is a matter of indifference, except in very uneven roads, and where there are deep ruts; long carriages being preferable in the former caſe, and ſhort ones in the latter.

The reaſon why ſprings ſo much facilitate the draught of carriages ſeems to be, not only that they allow the wheels to paſs more gradually over the obſtacles, as Mr Edgeworth ſays, but that by their elaſticity they make the carriage bound upwards every moment for a ſmall way. Thus its gravity is for that moment in a great meaſure counteracted, and the progreſſive motion which it has already acquired is at liberty to act more freely in puſhing it forward; for were it poſſible very ſuddenly to take away the horſes from a carriage mounted on ſprings, and moving with conſiderable velocity, it would continue for ſome time to move of itſelf; the weight in this caſe acting as a fly upon any mechanical engine, by means of which the machine accumulates a certain quantity of power, and will keep itſelf in motion for a conſiderable time after the hand is taken away from it. The weight of all carriages indeed has ſome effect of this kind, otherwiſe the draught would require an intolerable exertion of ſtrength; and it is to be obſerved, that this tendency to proceed in the direction in which it is once ſet a-going, is remarkable in all great quantities of matter, and very perceptible even when weights are pulled directly upward; for in raiſing great weights by a crane, the burden is lifted with conſiderably more eaſe when near the top than at bottom, even after making every neceſſary allowance for the weight of the rope, &c.

55
A carriage to go without any other force than what it receives from the paſſengers.
Fig. 85.

By means of wheels, ſome people have contrived carriages to go without horſes, or any other moving power than what was given by the paſſengers, by the wind, &c. One of theſe is repreſented by ABCD. It is moved by the footman behind it; and the fore-wheels, which act as a rudder, are guided by the perſon who ſits in the carriage (A).

Between the hind-wheels is placed a box, in which is concealed the machinery that moves the carriage. AA (fig. 86.) is a ſmall axis fixed into the box. B is a pulley, over which runs a rope, whoſe two ends are faſtened to the ends of the two levers or treddles CD, whoſe other ends are fixed in ſuch manner in the piece E, which is joined to the box, that they can eaſily move up and down. F, F, are two flat pieces of iron that are joined to the treddles, and take the teeth of the two wheels H, H, which are fixed on the ſame axis with the hind-wheels of the carriage, I, I.

It is evident, that when the footman behind preſſes down one of the treddles, ſuppoſe C, with his foot, he muſt bring down one of the pieces of iron F, and conſequently turn the wheel H that is next to it; and at the ſame time, by means of the rope that goes over the pulley, he muſt raiſe the other treddle D, together with its piece F, which being thruſt down will turn the other wheel H; and ſo alternately: and as the great wheels are fixed on the ſame axis, they muſt neceſſarily move at the ſame time.

It is eaſy to conceive, that if the ends of the treddles next E, inſtead of being placed behind the carriage, were turned the oppoſite way, ſo as to come under the feet of the perſon who ſits in it, he might move it with equal, or even greater facility, than the footman, as it would then be charged with the weight of one perſon only.

A machine of this kind will afford a ſalutary recreation in a garden or park, or on any plain ground; but in a rough or deep road muſt be attended with more pain than pleaſure.

56
To ſail as faſt, with a fair wind, by land, as by water:
Fig. 87.

Another contrivance for being carried without draught, is by means of a ſailing chariot or boat fixed on four wheels, as AB; which is driven before the wind by the ſails CD, and guided by the rudder E. In a chariot of this kind, the wheels ſhould be farther aſunder, and the axle-trees longer, than in other carriages, to prevent overturning.

A machine of this ſort was conſtructed in the laſt century by Stephinus, at Scheveling in Holland, and is celebrated by many writers. Its velocity with a ſtrong wind is ſaid to be ſo great, that it would carry eight or ten perſons from Scheveling to Putten, which is 42 Engliſh miles diſtant, in two hours.

Carriages of this kind are ſaid to be frequent in China; and in any wide, level country muſt be ſometimes both pleaſant and profitable. The great inconvenience attending the machine is, that it can only go in the direction the wind blows, and even not then unleſs it blow ſtrong: ſo that, after you have got ſome way on your journey, if the wind ſhould fail, or change, you muſt either proceed on foot or go back. Some remedy for this inconvenience will be found in the next contrivance. The Hollanders have, or had, ſmall veſſels, ſomething of this kind, that carry one or two perſons on the ice, having a ſledge at bottom inſtead of wheels: and being made in the form of a boat, if the ice break the paſſengers are ſecured from drowning.

To ſail againſt the wind: Let ABCD be the body of a ſailing chariot: M the maſt, to which are fixed the wings or ſails EFGH; the two firſt of which, EF, are here ſuppoſed to be expanded by the wind; R is the rudder by which it is guided. Therefore the wind driving

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(A) This machine was invented by M. Richard, a phyſician of Rochelle, and was exhibited at Paris in the laſt century. It is deſcribed by M. Ozanam in his *Recreations Mathematiques*.

Fig. 82.

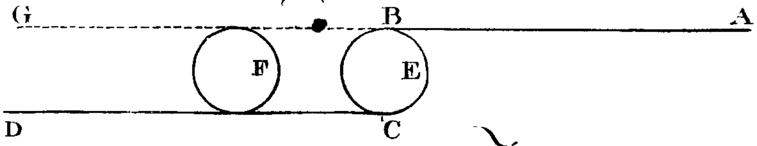


Fig. 86.

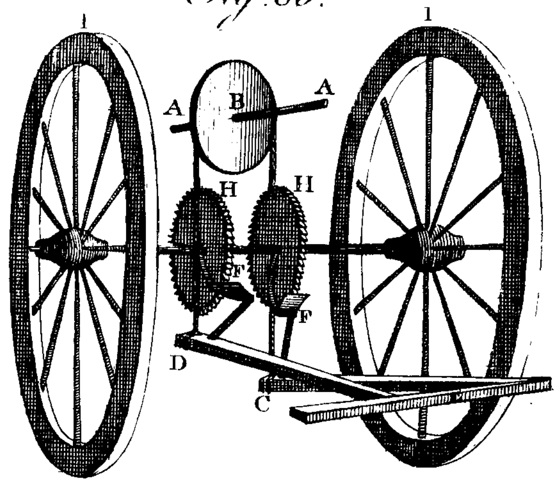


Fig. 83.

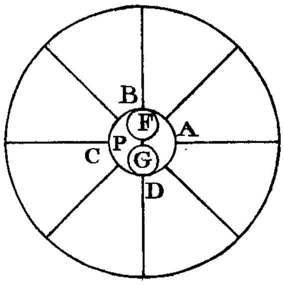


Fig. 85.

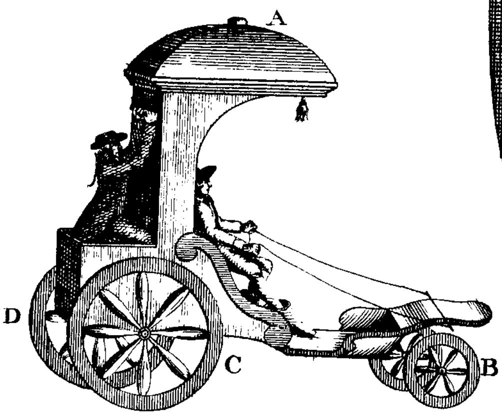


Fig. 87.

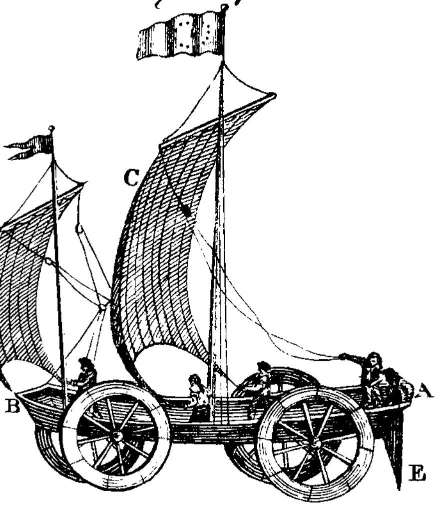


Fig. 84.

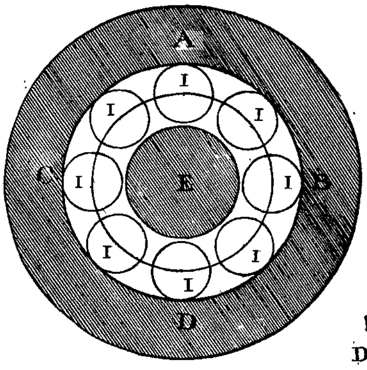


Fig. 88.

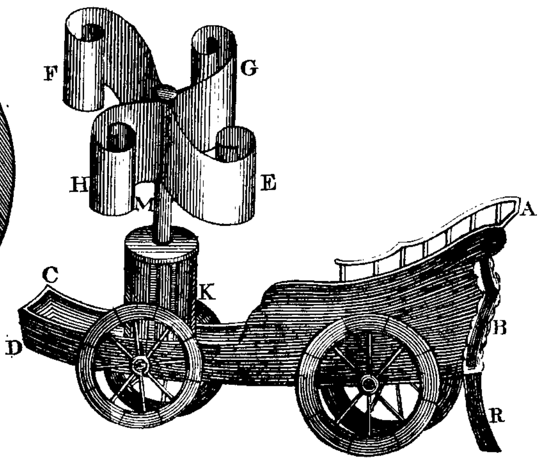


Fig. 89.

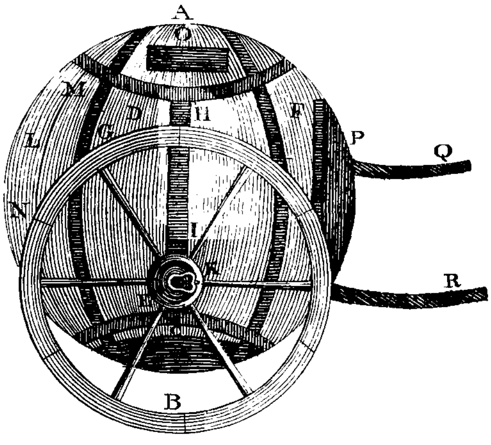
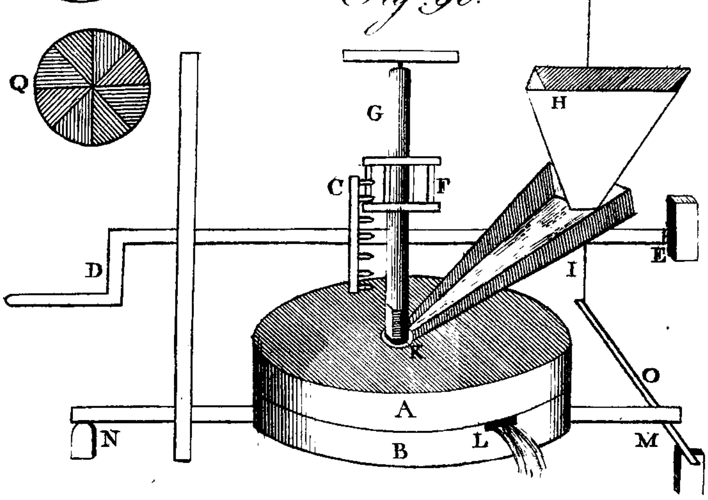


Fig. 90.



Scot Sc. Philada.

driving the ſails round, with the maſt M, and the cog-wheel K, take the teeth placed perpendicular to the ſides of the two fore-wheels of the carriage, and conſequently keep it in continual motion.

The body of this machine ſhould not be large, nor placed very high, not only to prevent overturning, but that its motion may not be thereby impeded; for the velocity will be in proportion to the force of the wind on the ſails to that on the body of the machine. Therefore, if they be both equal, it will ſtand ſtill; or if the force on the body be greateſt, it will go backwards; unleſs there be a contrivance to lock the wheels. The upper part of the machine next A, may be made to take off when the wind is contrary; and there may be another ſet of ſails placed between the two hind-wheels, which will conſiderably increaſe its velocity. But after all, for general uſe, a common carriage muſt be preferable: for this cannot be expected to go up a moderate aſcent without great difficulty; nor down a declivity, when there is a ſtrong wind, without danger; and even on level ground, if the road be in any degree rough, its progreſs muſt be very ſlow, attended both with difficulty and danger. In an open country, however, where there is a large tract of level and ſmooth ground, and frequent ſtrong winds, a machine of this ſort will certainly be very convenient; and in moſt countries, when made of a ſmall ſize, may be uſeful to young people, by affording them a pleaſant and healthful exerciſe.

58
The uninvertible carriage.
Fig. 89.

A carriage, the body of which is incapable of being overturned, may be made as follows. The body muſt conſiſt of a regular hollow globe, as AB, at the bottom of which is to be an immoveable weight, and which muſt be proportioned to the number of perſons or the load the machine is intended to carry. Round the globe muſt go two horizontal iron circles D, E, and two others F, G, that are perpendicular to the former. All theſe circles muſt be made exactly to fit the globe, that it may move freely in every direction. The two horizontal circles are to be joined on each ſide by a perpendicular bar, one of which is expreſſed in the figure by HI. All theſe irons ſhould be lined with leather, to prevent unneceſſary friction. The body of the carriage may be either of leather or hard wood; but the latter will be moſt eligible, as leaſt liable to wear. The wheel on each ſide is to be faſtened to the perpendicular by means of a handle K that keeps it ſteady.

Now the body of this machine moving freely in the iron circles every way, the centre of gravity will always lie at C; therefore, in whatever poſition the wheels are, or even if they overturn, the body of the carriage will conſtantly remain in the ſame perpendicular direction.

At L is placed a pin, round which is a hollow moveable cylinder: this pin moves up and down in the groove MN, that it may not impede the perpendicular motion of the circles, at the ſame time that it prevents the body of the machine from turning round in a horizontal direction. O is one of the windows, P the door, and QR the ſhafts to this machine.

When a carriage of this ſort is intended for a ſingle perſon, or a light weight, it may be hung on ſwivels, in the ſame manner as the rolling lamp or the ſea-compaſs, which will make its horizontal motion ſtill more regular: and when it is deſigned to carry ſeveral perſons, by adding another perpendicular bar on each ſide, between the two horizontal circles, it may be placed on four wheels. The body of this machine ſhould be frequently oiled or greaſed, not only to prevent any diſagreeable noiſe that may ariſe from its rubbing againſt the circles, but to prevent unneceſſary wear in the ſeveral parts.

This carriage is not intended for ſmooth roads, or a regular pavement; there certainly, thoſe of the common conſtruction are much preferable; nor ſhould a carriage totally free from irregular motion be ſought after by thoſe who are in perfect health: but there are many perſons, ſubject to different diſorders, who by being obliged to travel over rough roads in the common carriages, ſuffer tortures of which the healthful have no idea; to all theſe, therefore, and to every one who is forced to travel through dangerous roads, a carriage of this ſort muſt doubtleſs be highly deſirable.

As this deſign may appear to ſome perſons, on a ſuperficial view, impracticable, we ſhall here inſert an account of a ſimilar carriage, which we have taken from the firſt volume of the Abridgement of the Philoſophical Tranſactions, by Lowthorp. There is not, however, any deſcription of the manner in which that machine was conſtructed. The account is as follows: "A new ſort of calaſh deſcribed by Sir R. B. This calaſh goes on two wheels; carries one perſon; is light enough. Though it hangs not on braces, yet it is eaſier than the common coach. A common coach will overturn if one wheel go on a ſuperficies a foot and a half higher than the other; but this will admit of the difference of three feet and one third in height of the ſuperficies, without danger of overturning. We choſe all the irregular banks, and ſides of ditches, to run over; and I have this day ſeen it, at five ſeveral times, turn over and over, and the horſe not at all diſordered. If the horſe ſhould be in the leaſt unruly, with the help of one pin you diſengage him from the calaſh without any inconvenience *(a contrivance of this ſort may be eaſily added to the foregoing deſign)*. I myſelf have been once overturned, and knew it not till I looked up and ſaw the wheel flat over my head: and if a man went with his eyes ſhut, he would imagine himſelf in the moſt ſmooth way, though at the ſame time there be three feet difference in the height of the ground of each wheel."

SECT. V. *Of Mills.*

MILL, in the proper ſenſe of the word, ſignifies a machine for grinding corn, though, in a more general ſenſe, it is applied to all machines which have any horizontal circulatory motion. Mills are diſtinguiſhed by particular names, ſometimes taken from the powers by which they are moved, and ſometimes from the uſes to which they are applied. Hence they are called hand-mills, horſe-mills, water-mills, fulling-mills, wind-mills, corn-mills, levigating-mills, boring mills, &c.

59
A hand-mill.

The moſt ſimple of theſe is the *hand-mill*, repreſented fig. 90, where A and B repreſent the two ſtones between which the corn is ground, and of which the upper one A turns round, but the lower one (B) remains

mains fixed and immoveable. The upper ſtone is five inches thick, and 21 inches broad; the lower one ſomewhat broader. C is a cog-wheel, having 16 or 18 cogs, which go into the trundle F, having nine ſpokes fixed to the axis G, the latter being firmly inſerted into the upper ſtone A, by means of a piece of iron. H is the hopper into which the corn is put; I the ſhoe to carry it by little and little through a hole at K, in betwixt the ſtones, where being ground into meal, it comes out through the eye at L. Both ſtones are incloſed in a circular wooden caſe, of ſuch a ſize as will admit the upper one to run freely within it.—The under ſurface of the upper ſtone is cut into grooves, as repreſented at Q, which enable it to throw the meal out at the eye L more perfectly than could be done if it was quite plain. Neither of them are entirely flat, the upper one being ſomewhat concave, and the under one convex. They nearly touch at the edges, but are at ſome diſtance in the middle, in order to let the corn go in between them. The under ſtone is ſupported by ſtrong beams, not repreſented in the figure; the ſpindle G ſtands on the beam MN, which lies upon the bearer O. One end of this bearer reſts upon a fixed beam, and the other has a ſtring fixed to it, and going round the pin P, by the turning of which the timbers O and MN may be raiſed or lowered, and thus the ſtones put nearer, or removed farther from each other, in order to grind fine or coarſe. When the corn is to be ground, it muſt be put into the hopper by little at a time. A man turns the handle D, and thus the cog-wheel and trundle are carried round alſo together with the ſtone A. The axis G is angular at K; and, as it goes round, ſhakes the ſhoe I, and makes the corn fall gradually through the hole K. The upper ſtone going round grinds it, throwing out the meal, as already ſaid, at the eye L. Another handle, if thought proper, may be put at the other end of the handle E. The ſpindle muſt go through both ſtones, in order to reach the beam MN, and the hole through which it paſſes is faſtened with leather or wood, ſo that no meal can paſs through. Mr Emerſon, from whom this account is taken, obſerves, that "it is a pity ſome ſuch mills are not made at a cheap rate, for the ſake of the poor, who are much diſtreſſed by the roguery of the millers."

60 Horſe-mill. The conſtruction of a horſe-mill differs not from that of the hand-mill juſt deſcribed, excepting that inſtead of the handle D, the ſpindle is furniſhed with a long horizontal lever and cogged wheel, which turns the trundle and ſtones, as already mentioned.—The ſtones are much heavier than in the hand-mill.

61 Water-mills. The mills moſt commonly in uſe for grinding corn are water-mills, the conſtruction of which is not eſſentially different from that of the hand or horſe-mills.—The lower mill-ſtone, as already mentioned, is fixed, but the upper one moveable upon a ſpindle. The oppoſite ſurfaces of the two ſtones are not flat, but the one convex and the other concave, though in a very ſmall degree. The upper ſtone, which is ſix feet in diameter, is hollowed only about an inch in the middle, and the other riſes three quarters of an inch. They approach much nearer each other at the circumference, and the corn begins to be ground about two thirds of the radius diſtant from the circumference, and there it makes the greateſt reſiſtance, the ſpace between the two ſtones being in that place only about two-thirds or three-fourths of the thickneſs of a grain of corn; but as theſe ſtones, as well as thoſe of the hand-mill or horſe-mill, can be ſeparated a little from each other, the meal may be made fine or coarſe in them, as well as in the two former mills.

In order to cut and grind the corn, both the upper and under ſtones have furrows cut in them, as is obſerved in the hand-mill. Theſe are cut perpendicularly on one ſide, and obliquely upon the other, by which means each furrow has a ſharp edge, and by the turning of the ſtones, the furrows meet like a pair of ſciſſars, and by cutting the corn, make it grind the more eaſily. They are cut the ſame way in both ſtones when they lie upon their backs, by which means they run croſswiſe to each other when the upper one is inverted and turned round; and this greatly promotes the grinding of the corn, great part of which would be driven onward in the lower furrows, without being ground at all, if both lay the ſame way.—When the furrow becomes blunt and ſhallow by wearing, the running ſtone muſt be taken off, and the furrows cut deeper in both by means of a chiſſel and hammer. Thus, however, by having the furrows cut down a great number of times, the thickneſſes of both ſtones are greatly diminiſhed; and it is obſerved, that in proportion to the diminution of the thickneſs of the upper ſtone, the quantity of flour alſo diminiſhes.

By means of the circular motion of the upper ſtone, the corn is brought out of the hopper by jerks, and recedes from the centre towards the circumference by the centrifugal force; and being entirely reduced to flour at the edges where the ſtones nearly touch one another, it is thrown at laſt out at the hole called the eye, as already mentioned. In Scotland, it is frequent to have the ſtones without any furrows, and only irregularly indented with ſmall holes, by means of an iron inſtrument. Stones of this kind laſt a much ſhorter time than thoſe with furrows, the latter being fit for uſe for 30 or 40 years, while the former ſeldom or never laſt more than ſeven. The under millſtone is conſiderably thicker than the upper; and therefore, when both have been conſiderably worn by uſe, the lower one is frequently taken up, and the upper one put in its place, the former being converted into a running-ſtone.

62 Of water-mills. Plate CCLXXXIX. Fig. 91. ſhows the conſtruction of a common water mill, where AA is the large water-wheel, commonly about 17 or 18 feet diameter from *a*, the extremity of any float-board, to *b* the extremity of the oppoſite one. This wheel is turned round by the falling of the water upon the boards from a certain height, and the greater the height, provided the water runs in an uninterrupted ſtream, the ſmaller quantity will be ſufficient to turn the mill. This wheel is without the mill-houſe, but the wheel has an axle BB of conſiderable length, which paſſes through a circular hole in the wall, and has upon it a wheel D, of eight or nine feet diameter, having 61 cogs, which turn a trundle E of ten ſtaves or ſpokes; by which means the trundle, and conſequently the mill-ſtone, will make ſix revolutions, and one tenth for every revolution of the wheel. The odd cog, commonly called the *hunting* cog, is added, that as every one comes to the trundle it may take the ſtaff behind that one which it took at the laſt revolution;

tion; and thus all the parts of the cogs and rounds which work upon one another, will wear equally and to equal diſtances from another, in a little time; by which means a true uniform motion will be produced through the whole work. The trundle is fixed upon an iron axis called the ſpindle, the lower end of which turns in a braſs pot fixed at F in the horizontal beam ST, called the *bridge-tree*; and the upper part of the ſpindle turns in a wooden buſh, fixed into the lower mill-ſtone which lies upon beams in the floor YY. The top part of the ſpindle above the buſh is ſquare, and goes into a ſquare hole in a ſtrong iron croſs *abcd*, fig. 92, called the *rynd*; under which, and cloſe to the buſh, is a round piece of thick leather upon the ſpindle, which it turns round at the ſame time that it does the rynd. The latter enters into the grooves in the under ſurface of the running mill-ſtone G. fig. 91, and thus turns it round along with the trundle E, by means of the cog-wheel D. In the middle of the upper mill-ſtone is a large hole called the *eye*, through which the middle part of the rynd and upper part of the ſpindle may be ſeen; the ends being hid in the grooves below the ſtone. The end T of the bridge-tree TS, which ſupports the upper mill ſtone G upon the ſpindle, is fixed into a hole in the wall; and the end S is let into the beam QR called the *brayer*; one end R of which remains fixed in a mortiſe, while the other end Q hangs by a ſtrong iron rod P, which goes through the floor YY, and has a ſcrew-nut on its top O; by the turning of which nut the end Q of the brayer is raiſed or depreſſed at pleaſure, along with the bridge-tree TS and upper mill-ſtone. Thus the upper mill-ſtone may be raiſed as high from the under one or let down as cloſe to it, as the miller pleaſes; by which means the meal or flour is made either coarſe or fine at pleaſure. The upper mill-ſtone G is incoſed in a round box H, which leaves a vacant ſpace of about an inch all round. On the top of this box ſtands a frame for holding the hopper *k k*, at which hangs the ſhoe I, by two lines faſtened to the hinder part of it fixed upon hooks in the hopper, and by one end of the ſtring K to the fore part of it at *i*, the other end being twiſted round the pin L. As the pin is turned one way, the ſtring draws up the ſhoe cloſer to the hopper, and ſo leſſens the aperture between them; and as the pin is turned the other way, it lets down the ſhoe, and widens the aperture. If it be drawn quite up to the hopper, no corn can fall out from the latter into the mill, and the quantity will be greater or leſs as the ſhoe is farther from the hopper or nearer to it. This happens by reaſon of the hopper being open at bottom, and the ſhoe at the forepart towards the end *i* over the middle of the eye of the mill-ſtone. There is alſo a ſquare hole in the top of the ſpindle, in which is put the feeder *e*. fig. 92. Thus the ſhoe is jogged three times in each revolution, and the corn runs conſtantly down from the hopper through the ſhoe into the eye of the mill-ſtone, where it falls upon the top of the rynd, and, by the motion of that and of the leather beneath, is introduced betwixt the ſtones, and by the violent motion of the upper one acquires a centrifugal force; and proceeding gradually from the eye of the mill-ſtone towards the circumference, is thrown at laſt out in flour, at the hole called the of the mill.

Some degree of nicety is requiſite in feeding the mill; for if too great a quantity be poured into it, the ſtones are ſeparated from each other more than they ought to be, and their motion is alſo impeded; while, on the other hand, if it be fed too ſlowly, the ſtone moves with too great velocity, and the attrition of the two is apt to make them ſtrike fire. This matter is regulated by turning the pin L backwards or forwards as the miller thinks proper.

Sometimes, where plenty of water can be had, there are two trundles applied to the cog-wheel by means of a ſingle large one turned immediately by the perpendicular cog-wheel, and carrying round with it an horizontal cogged wheel, on each ſide of which are placed the ſmaller trundles abovementioned, carrying the ſtones. In like manner, the water-wheel may be made to drive fanners, boulting mills, &c. but it muſt always be remembered, that by complicating machinery to a great degree, it becomes more ready to give way; and the frequent reparation of which it ſtands in need, will, by the delay of buſineſs, be found at laſt more expenſive than if ſeparate machines had been uſed.

The wind-mill is furniſhed with an apparatus ſimilar to the water-mill, but neceſſarily differs in the external apparatus for applying the power. This is done by means of the two arms AB and CD, fig. 93, interſecting each other at right angles in E, and paſſing through the axis EF, and about 32 feet in length.—On theſe yards are placed two ſails or vanes, in the ſhape ſometimes of parallelograms, and ſometimes of trapeziums, with parallel baſes; the greater whereof HI is about ſix feet, and the length of the ſmaller FG is determined by radii drawn from the centre E to I and H.

As the direction of the wind is very uncertain, it becomes neceſſary to have ſome contrivance for turning the ſails towards it, in order to receive its force, in whatever way it may turn: and for this purpoſe two general methods are in uſe. In the one, the whole machine is ſuſtained upon a moveable arbor or axis, perpendicularly to the horizon, and which is ſupported by a ſtrong ſtand or foot very firmly fixed in the earth; and thus by means of a lever the whole machine may be turned round as occaſion requires. In the other method, only the roof, which is circular, can be turned round by means of a lever and rollers, upon which the circular roof moves. This laſt kind of wind-mill is always built of ſtone, in the from of a round turret, having a large wooden ring on the top of it, above which the roof, which muſt likewiſe be of wood, moves upon rollers, as has been already mentioned. To effect this motion the more eaſily, the wooden ring which lies on the top of the building is furniſhed with a groove, at the bottom of which are placed a number of braſs truckles at certain diſtances, and within the groove is placed another ring, by which the whole roof is ſupported. The beams *ab* and *ae* are connected with the moveable ring, and a rope is faſtened to the beam *ab* in *b*, which at the other extremity is fitted to a windlaſs or axis in peritrochio; and this rope being drawn through the iron hook G, and the windlaſs turned round, the ſails and roof will be turned round alſo, in order to catch the wind in any direction. Both theſe methods of conſtruction have their advantages and diſadvantages. The former is the leaſt expenſive, as the whole may be made of wood, and of any form that is thought proper; while the other requires a coſtly building of ſtone: and the roof being round, the building muſt alſo be ſo, while the other can be made of any form, but has the inconvenience of being liable to be carried off altogether by a very high wind, of which an inſtance occurred not long ago in Eſſex.

Fig. 94. ſhows the internal mechaniſm of a windmill. AHO is the upper room; H *o*Z the lower one; AB the axle-tree paſſing through the mill; STVW the ſails covered with canvas ſet obliquely to the wind, and turning round in the order of the letters. CD is the cog-wheel, having about 48 cogs *a a a*, &c. which carry round the lantern EF, having eight or nine trundles *c c c*, &c. along with the axis GN. IK is the upper mill-ſtone, LM the Lower one; QR is the bridge ſupporting the axis or ſpindle GN, which reſts upon the beams *cd*, XY, wedged up at *c*, *d*, and X; ZY is the lifting tree, which ſtands upright; *ab* and *ef* are levers having Z and *e* as centers of motion; *fghi* is a cord, with a ſtone *i* wound about the pins *g* and *h*, and which thus ſerves as a balance or counterpoiſe. The ſpindle *t* N is fixed to the upper mill-ſtone IK by means of a piece of iron called the rynd, and fixed in the lower ſide of the ſtone, the whole weight which of reſts upon a hard ſtone fixed in the bridge QR at N. The trundle EF and axis G may be taken away; for it reſts its lower part by *t* in a ſquare ſocket, and the top runs in the edge of the beam *w*. By bearing down the end of the lever *fe* we raiſe *b*, which raiſes alſo ZY, and this raiſes YX, which lifts up the bridge QR, with the axis N G, and the upper ſtone IK; ſo that by this contrivance the ſtones may, as in a water-mill, be ſet at any diſtance. The lower ſtone is fixed upon ſtrong beams, and is broader than the upper one; the flour being conveyed through the tunnel *n o* into a cheſt. P is the hopper into which the corn, is put and which runs along the ſpout *r*, into the pole *t*, and ſo falls between the ſtones, where it is ground. The ſquare axis G *t* ſhakes the ſpout *r* as it turns round, and makes the corn run out, *r* is a ſtring going round the pin *s*, which ſerves to bring the ſpout nearer or let it go farther from the axis, and thus makes the corn to run faſter or ſlower according to the velocity of the wind. If the wind be very ſtrong, only part of the ſails S, T, V, W, is covered, or perhaps only one half of the two oppoſite ſails. Another cog-wheel B is placed towards the end B of the axle-tree, with a trundle and mill-ſtones like thoſe already deſcribed: ſo that when the wind is ſtrong, the mill may do twice the buſineſs it ordinarily does. When only one pair is to grind, the trundle EF and axis G *t* are taken out from the other: *xyl* is a girt of pliable wood, fixed at the end *x*; and the other end *l* is tied to the lever *km* moveable about *k*; and the end *m* being put down, draws the girt *xyl* cloſe to the cog-wheel; and thus the motion of the mill may be ſtopped at pleaſure: *pq* is a ladder for aſcending to the higher part of the mill; and the corn is drawn up by means of a rope rolled about the axis AB.

63
A threſhing mill.

Beſides theſe mills for grinding corn, one has lately been invented by a Mr Winlaw for threſhing it out, and for which he has obtained a patent. It is repreſented fig. 95. AAAA repreſents the frame of the mill, B the cone, C a large iron wheel, D a regulating ſcrew, E a pinion, G the top curb ſurrounding the nut, H the fly.

Before the corn is put into this mill, it muſt undergo the operations of combing the bottoms of the ſheaves, and ſtripping the ears from the ſtraw. The former is performed by means of an hand-comb. The uſe is obvious, viz. to take out all the looſe ears, and ſtraw laid irregularly, which would otherwiſe be loſt, or impede the ſtripping of the ears. The comb for ſtripping the ears is made in the form of a croſs. The teeth are of an angular form, and ſet at convenient diſtances, ſo as to ſtrip the ears clean. If ſet too wide, they will paſs through without effect; and if too near together, they will not admit the ſtraw to go between them.

The grain is ſeparated from the chaff and ſtraw of the ear by the motion of the inner nut within the outward cone. The diſtance betwixt theſe is adjuſted by the regulating ſcrew D at the bottom; for if this be ſcrewed up too far, the grain will be bruiſed, if too far lowered down, the grain will not be ſeparated. The dart marked upon the fly ſhows the direction in which the handle is to be turned, it being pointed as the handle is to be turned.

This mill was tried in the month of June 1785, in the preſence of a number of gentleman, with great ſatisfaction to the ſpectators; and ſince that time has been uſed by a number of others, though it has not as yet come into general uſe. At the firſt trial there paſſed through the mill one buſhel of heads per minute, with very moderate labour to the man who turned it: and by experiment it was found, that four buſhels of ears yielded one buſhel of clean grain. Hence it appears, that the difference betwixt the expedition of the mill and the labour of the threſher is immenſely great; for allowing that a man will threſh a ſix buſhels per day at eight hours work, the mill will clear that quantity in 24 minutes, and that to much greater perfection than can be done by the flail, as it ſepapartes every grain from the ear, which cannot but be accounted a very great ſaving; while much corn flies off by the flail, and a great deal is loſt by foul threſhing, either when performed by taſk or day-work. But by the uſe of the mill, all fraudulent practices muſt be prevented, the ſtraw preſerved in its original reed, and thus anſwer the purpoſes of thatching, &c. much better than when bruiſed under the flail; and every other purpoſe equally well. The ears may alſo be combed out with great expedition, as a lad without having practiſed was found to comb out a buſhel of ears in 20 minutes, which is at the rate of ſix buſhels of clean corn per day.—The ſaving by the uſe of this mill is calculated at 2½d. per buſhel. On a ſmaller ſcaler the mill anſwers equally well for clover-ſeed, the flowers being firſt combed off from the ſtems, after which it will do as much work in three hours, as a man in the ordinary way can perform in a week; for a man cannot clean much above a buſhel in that time, which is the great reaſon of the high price of clover-ſeed. The mill will likewiſe anſwer for flax, canary, or any other ſeeds, or for ſeparating the huſks from rice, which in the preſent mode cannot be done without great labour and expence.

In all mills it is neceſſary that a conſiderable power be

Fig. 92

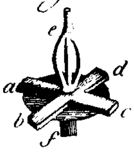


Fig. 93

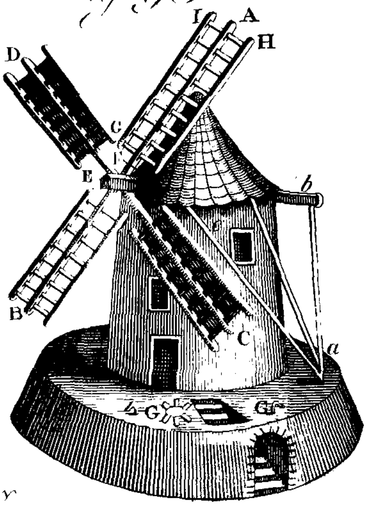


Fig. 91

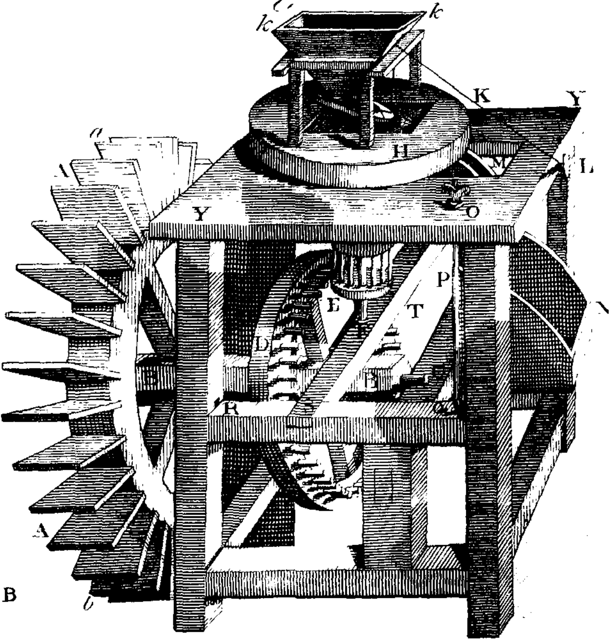


Fig. 99

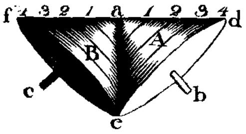


Fig. 94

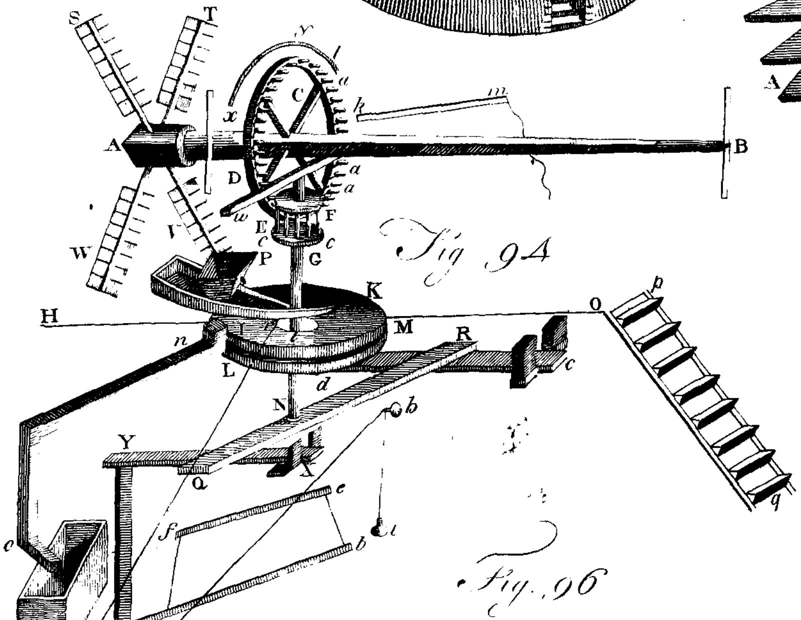


Fig. 95

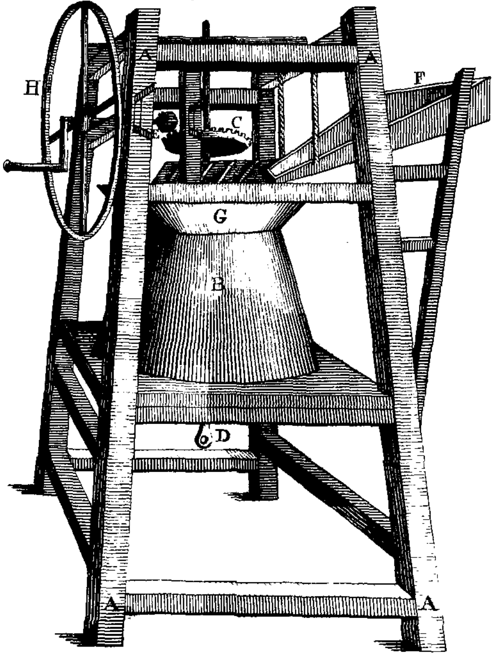


Fig. 96

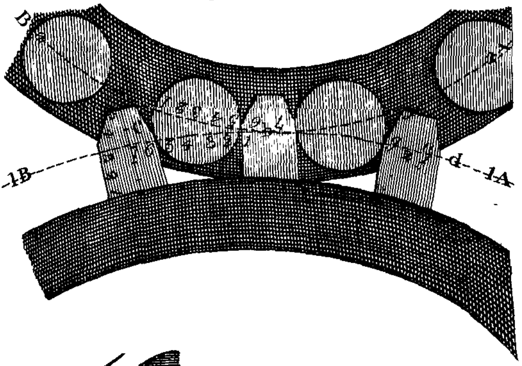


Fig. 100

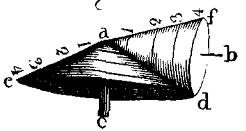


Fig. 97

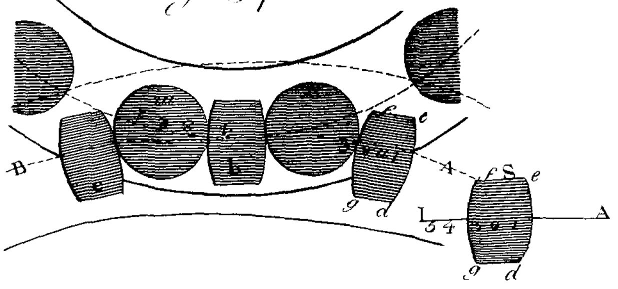
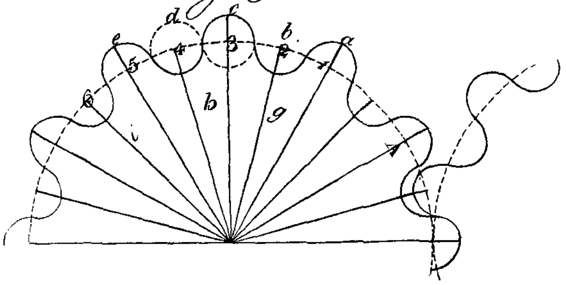


Fig. 98



S. Allardice Sc.

be employed in order to accompliſh the intended purpoſe. Water is the moſt common power, and indeed the beſt, as being the moſt conſtant and equable; while wind comes at ſometimes with great violence, and at others is totally gone. Mills may alſo be moved by the force of ſteam, as were the Albion-mills at London; but the expence of fuel muſt undoubtedly prevent this mode of conſtructing mills from ever becoming general. In all caſes it is abſolutely neceſſary to make the moſt of the power that we can, by making it act to the greateſt advantage. Hence the beſt methods of conſtructing water and wind-mills have been inveſtigated by thoſe who were moſt converſant in the principles of mechanics; and ſo difficult has been the inveſtigation, that the principles are not yet ſettled abſolutely without diſpute.

64
Different kinds of mills.

The water-mills are of three kinds; *Breaſt-mills*, *Underſhot-mills*, and *Overſhot-mills*. In the former, the water falls down upon the wheel at right angles, to the float-boards or buckets placed all round the wheel to receive it: if float-boards are uſed, it acts only by its impulſe; but if buckets, it acts alſo by the weight of water in the buckets in the under quarter of the wheel, which is conſiderable. In the underſhot wheel float-boards only are uſed, and the wheel is turned merely by the force of the current running under it, and ſtriking upon the boards. In the overſhot wheel the water is poured over the top, and thus acts principally by its weight; as the fall upon the upper part of the wheel cannot be very conſiderable, leſt it ſhould daſh the water out of the buckets. Hence it is evident, that an underſhot-mill muſt require a much larger ſupply of water than any other; the breaſt-mill the next, unleſs the fall is very great; and an overſhot mill the leaſt. Dr Deſaguliers found, that a well-made overſhot mill would perform as much work as an underſhot one with one tenth part of the quantity of water required by the other.

65
Smeaton's obſervations on mills.

In the 51ſt volume of the Philoſophical Tranſactions, Mr Smeaton has conſidered at great length the beſt methods of conſtructing all theſe mills from machines and models made on purpoſe: but conſcious of the inferiority of *models* to actual practice, did not venture to give his opinion without having ſeen them actually tried, and the truth of his doctrines eſtabliſhed by practice.

Having deſcribed the machines and models uſed for making his experiments, he obſerves, that, with regard to power, it is moſt properly meaſured by the raiſing of a weight; or, in other words, if the weight raiſed be multiplied by the height to which it can be raiſed in a given time, the product is the meaſure of the power raiſing it; and, of conſequence, all thoſe powers are equal whoſe products made by ſuch multiplication are equal: for if a power can raiſe twice the weight to the ſame height, or the ſame weight to twice the height in the ſame time that another can, the former power will be double the latter; but if a power can only raiſe half the weight to double the height, or double the weight to half the height, in the ſame time that another can, the two powers are equal. This, however, muſt be underſtood only of a ſlow and equable motion, without acceleration or retardation; for if the velocity be either very quickly accelerated or retarded, the *vis inertiæ*, in our authors opinion, will produce an irregularity.

To compute the effects of water-wheels exactly, it is neceſſary to know in the firſt place what is the real velocity of the water which impinges on the wheel. 2. The quantity of water expended in a given time: and, 3. How much of the power is loſt by the friction of the machinery.

1. With regard to the velocity of the water, Mr Smeaton determined by experiments with the machinery deſcribed in the volume referred to, that with a head of water 15 inches in height, the velocity of the wheel is 8.96 feet in a minute. The area of the head being 105.8 inches, this multiplied by the weight of a cubic inch of water equal to .579 of an ounce avoirdupoiſe, gives 61.26 ounces for the weight of as much water as is contained in the head upon one inch in depth: and by further calculations derived from the machinery made uſe of, he computes that 264.7 pounds of water deſcend in a minute through the ſpace of 15 inches. The power of the water, therefore, to produce mechanical effects in this caſe will be 264.7×15, or 3970. From the reſult of the experiment, however, it appeared that a vaſt quantity of the power was loſt; the effect being only to raiſe 9.375 pounds to the height of 135 inches; ſo that the power was to the effect as 3970 to $9.375 \times 135 = 1266$, or as 10 to 3.18.

This, according to our author, muſt be conſidered as the greateſt ſingle effect of water upon an underſhot-wheel, where the water deſcends from an height of 15 inches; but as the force of the current is not by any means exhauſted, we muſt conſider the true proportion betwixt the power and effect to be that betwixt the quantity of water already mentioned and the ſum of all the effects producible from it. This remainder of power, it is plain, muſt be equal to that of the velocity of the wheel itſelf multiplied into the weight of the water. In the preſent experiment, the circumference of the wheel moved with the velocity of 3.123 feet in a ſecond, which anſwers to a head of 1.82 inches (A); and this height being multiplied by 264.7, the quantity of water expended in a minute gives 481 for the power of the water after it has paſſed the wheel; and hence the true proportion betwixt the power and the effect will be as 3849 to 1266; or as 11 to 4.

As the wheel revolved 86 times in a minute, the velocity of the water muſt be equal to 86 circumferences of the wheel; which, according to the dimenſions of the apparatus uſed by Mr Smeaton, was as 86 to 30, or as 20 to 7.—The greateſt load with which the wheel would move was 9 lb. 6 oz.; and by 12 lb. it was entirely ſtopped. Whence our author concludes

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(A) Theſe calculations are founded upon the known maxim in hydroſtatics, that the velocity of ſpouting water is nearly the ſame with that which an heavy body would acquire by falling from an height equal to that of the reſervoir, and is proved by the riſing of jets nearly to the height of their reſervoirs.

cludes, that the impulſe of the water is more than double of what it ought to be according to theory: but this he accounts for by obſerving, that in his experiment the wheel was placed not in an open river, where the natural current, after it has communicated its impulſe to the float, has room on all ſides to eſcape, as the theory ſuppoſes, but in a conduit, to which the float being adapted, the water cannot otherwiſe eſcape than by moving along with the wheel. It is obſervable, that a wheel working in this manner, as ſoon as the water meets the float, receiving a ſudden check, it riſes up againſt the float like a wave againſt a fixed object, inſomuch that when the ſheet of water is not a quarter of an inch thick before the float, yet this ſheet will act upon the whole ſurface of a float whoſe height is three inches: and conſequently, was the float no higher than the thickneſs of the ſheet of water, as the theory alſo ſuppoſes, a great part of the force would have been loſt by the water daſhing over the float.

Mr Smeaton next proceeds to give tables of the velocities of wheels with different heights of water; and from the whole deduces the following concluſions.

1. The virtual, or effective head, being the ſame, the effect will be nearly as the quantity of water expended.

2. The expence of water being the ſame, the effect will be nearly as the height of the virtual or effective head.

3. The quantity of water expended being the ſame, the effect is nearly as the ſquare of the velocity.

4. The aperture being the ſame, the effect will be nearly as the cube of the velocity of the water. Hence, if water paſſes out of an aperture in the ſame ſection, but with different velocities, the expence will be proportional to the velocity; and therefore, if the expence be not proportional to the velocity, the ſection of the water is not the ſame.

5. The *virtual* head, or that from which we are to calculate the power, bears no proportion to the head water; but when the aperture is larger, or the velocity of the water leſs, they approach nearer to a coincidence: and conſequently, in the large openings of mills and ſluices, where great quantities of water are diſcharged from moderate heads, the head of water, and virtual head determined from the velocity, will nearly agree, which is alſo confirmed by experience.

6. The moſt general proportion betwixt the power and effect is that of 10 to 3; the extremes 10 to 3.2, and 10 to 2.8. But as it is obſervable, that where the power is greateſt, the ſecond term of the ratio is greateſt alſo; whence we may allow the proportion ſubſiſting in great works to be as three to one.

7. The proportion of velocity between the water and wheel is in general about 5 to 2.

8. There is no certain ratio between the load that the wheel will carry at its *maximum*, and what will totally ſtop it; though the proportions are contained within the limits of 20 to 19, and 20 to 15; but as the effect approaches neareſt to the ratio of 20 to 15, or of 4 to 3 when the power is greateſt either by increaſe of velocity or quantity of water, this ſeems to be the moſt applicable to large works: but as the load that a wheel ought to have, in order to work to the beſt advantage, can be aſſigned by knowing the effect that it ought to produce, and the velocity it ought to have in producing it, the exact knowledge of the greateſt load it will bear is of the leaſt conſequence in practice.

Mr Smeaton, after having finiſhed his experiments on the underſhot mills, reduced the number of floats, which were originally 24, to 12; which cauſed a diminution in the effect, by reaſon that a greater quantity of water eſcaped between the floats and the floor than before; but on adapting to it a circular ſweep of ſuch a length, that one float entered into the curve before the other left it, the effect came ſo near that of the former, as not to give any hopes of advancing it by increaſing the number of floats beyond 24 in this particular wheel.

Our author next proceeds to examine the power of water when acting by its own gravity in turning an overſhot wheel: "In reaſoning without experiment (ſays he), one might be led to imagine, that however different the mode of application is, yet that, whenever the ſame quantity of water deſcends through the ſame perpendicular ſpace, the natural effective power would be equal, ſuppoſing the machinery free from friction, equally calculated to receive the full effect of the power, and to make the moſt of it: for if we ſuppoſe the height of a column of water to be 30 inches, and reſting upon a baſe or aperture of one inch ſquare, every cubic inch of water that departs therefrom will acquire the ſame velocity or momentum from the uniform preſſure of 30 cubic inches above it, that one cubic inch let fall from the top will acquire in falling down to the level of the aperture; one would therefore ſuppoſe that a cubic inch of water let fall through a ſpace of 30 inches, and there impinging upon another body, would be capable of producing an equal effect by colliſion, as if the ſame cubic inch had deſcended through the ſame ſpace with a ſlower motion, and produced its effects gradually. But however concluſive this reaſoning may ſeem, it will appear in the courſe of the following deductions, that the effect of the gravity of deſcending bodies is very different from the effect of the ſtroke of ſuch as are non-elaſtic, though generated by an equal mechanical power."

Having made ſuch alterations in his machinery as were neceſſary for overſhot wheels, our author next gives a table of experiments with the apparatus ſo altered. In theſe the head was ſix inches, and the height of the wheel 24 inches; ſo that the whole deſcent was 30 inches: the quantity of water expended in a minute was 96$\frac{1}{3}$ pounds; which multiplied by 30 inches, gives the power =2900: and after making the proper calculations, the effect was computed at 1914; whence the ratio of the power to it comes to be nearly as 3 to 2. If, however, we compute the power from the height of the wheel only, the power will be to the effect nearly as 5 to 4.

From another ſet of experiments the following concluſions were deduced.

1. The effective power of the water muſt be reckoned upon the whole deſcent; becauſe it muſt be raiſed to that height in order to be able to produce the ſame effect a ſecond time. The ratios between the

powers ſo eſtimated and the effects at a *maximum*, differ nearly from 4 to 3, and from 4 to 2. Where the heads of water and quantities of it expended are the leaſt, the proportion is nearly from 4 to 3; but where the heads and quantities are greateſt, it comes nearer to that of 4 to 2; ſo that by a medium of the whole the ratio is nearly as 3 to 2. Hence it appears, that the effect of overſhot wheels is nearly double to that of underſhot ones; the conſequence of which is, that non elaſtic bodies, when acting by their impulſe or colliſion, communicate only a part of their original impulſe, the remainder being ſpent in changing their figure in conſequence of the ſtroke. The ultimate concluſion is, that the effects as well as the powers are as the quantities of water and perpendicular heights multiplied together reſpectively.

2. By increaſing the head, it does not appear that the effects are at all augmented in proportion; for by raiſing it from 3 to 11 inches, the effect was augmented by leſs than one-ſeventh of the increaſe of perpendicular height. Hence it follows, that the higher the wheel is in proportion to the whole deſcent, the greater will be the effect; becauſe it depends leſs upon the impulſe of the head, and more upon the gravity of the water in the buckets; and if we conſider how obliquely the water iſſuing from the head muſt ſtrike the buckets, we ſhall not be at a loſs to account for the little advantage that ariſes from the impulſe thereof, and ſhall immediately ſee of how little conſequence this is to the effect of an overſhot wheel. This, however, as well as other things, muſt be ſubject to limitation; for it is neceſſary that the velocity of the water ſhould be ſomewhat greater than the wheel, otherwiſe the latter will not only be retarded by the ſtriking of the buckets againſt the water, but ſome of the power will be loſt by the daſhing of the water over the buckets.

3. To determine the velocity which the circumference of the wheel ought to have in order to produce the greateſt effect, Mr Smeaton obſerves, that the more ſlowly any body deſcends by the force of gravity when acting upon any piece of machinary, the more of that force will be ſpent upon it, and conſequently the effect will be the greater. If a ſtream of water falls into the bucket of an overſhot wheel, it will be there retained till the wheel diſcharges it by moving round; and of conſequence, the ſlower the wheel moves, the more water it will receive; ſo that what is loſt in velocity is gained by the greater preſſure of water upon the buckets. From the experiments, however, it appears, that when the wheel made about 20 turns in a minute the effect was greateſt; when it made only $18\frac{1}{4}$ the motion was irregular; and when loaded ſo as not to admit its turning 18 times, the wheel was overpowered with the load. When it made 30 turns, the power was diminiſhed by about $\frac{1}{20}$th, and when the number of turns was increaſed to 40, it was diminiſhed by one-fourth. Hence we ſee, that in practice the velocity of the wheel ſhould not be diminiſhed farther than what will procure ſome ſolid advantage in point of power; becauſe, *ceteris paribus*, the buckets muſt be larger as the motion is ſlower; and the wheel being more loaded with water, the ſtreſs will be proportionably increaſed upon every part of the work. The beſt velocity for practice therefore will be that when the wheel made 30 turns in a minute, which is little more than three feet in a ſecond. This velocity is applicable to the higheſt overſhot wheels as well as the loweſt. Experience however determines, that high wheels may deviate further from this rule before they will loſe their power, by a given aliquot part of the whole, than low ones can be permitted to do; for a wheel of 24 feet high may move at the rate of 6 feet *per* ſecond; while our author has ſeen one of 33 feet high move very ſteadily and well with a velocity of little more than two feet. The reaſon of this ſuperior velocity in the 24 feet wheels may probably be owing to the ſmall proportion that the head requiſite to give the proper velocity to the wheel bears to the whole height

4. The maximum load for an overſhot wheel is that which reduces the circumference of the wheel to its proper velocity: which is known by dividing the effect it would produce in a given time by the ſpace intended to be deſcribed by the circumference of the wheel in the ſame time: the quotient will be the reſiſtance overcome at the circumference of the wheel, and is equal to the load required, including the friction and reſiſtance of the machinery.

5. The greateſt velocity that an overſhot wheel is capable of, depends jointly upon the diameter or weight of the wheel and the velocity of falling bodies: for it is plain that the velocity of the circumference can never be greater than to deſcribe a ſemi-circumference, while a body let fall from the top deſcribes the diameter, nor even quite ſo great; as the difference in point of time muſt always be in favour of that which falls through the diameter. Thus ſuppoſing the diameter of the wheel to be 16 feet and an inch in diameter, an heavy body would fall through this ſpace in one ſecond; but ſuch a wheel could never arrive at this velocity, or make one turn in two ſeconds, nor could an overſhot wheel ever come near it; becauſe, after it has acquired a certain velocity, great part of the water is prevented from entering the buckets, and part is thrown out again by the centrifugal force: and as theſe circumſtances have a conſiderable dependence upon the form of the buckets, it is impoſſible to lay down any general rule for the velocity of this kind of wheels.

6. Though in theory we may ſuppoſe a wheel to be made capable of overcoming any reſiſtance whatever, yet as in practice it is neceſſary to make the wheel and buckets of ſome certain and determinate ſize, we always find that the wheel will be ſtopped by ſuch a weight as is equal to the effort of the water in all the buckets of a ſemi-circumference put together. This may be determined from the ſtructure of the buckets themſelves; but in practice, an overſhot wheel becomes unſerviceable long before this time; for when it meets with ſuch an obſtacle as diminiſhes its velocity to a certain degree, its motion becomes irregular; but this never happens till the velocity of the circumference is leſs than the two feet *per* ſecond when the reſiſtance is equable.

7. From the above obſervations, we may eaſily deduce the force of water upon breaſt-wheels, &c. But in general, all kinds of wheels where the water cannot deſcend through a given ſpace unleſs the wheel moves with it, are to be conſidered as overſhot wheels; and

thoſe which receive the impulſe or ſhock of the water whether in an horizontal, oblique, or perdendicular direction, are to be conſidered as underſhots. Hence a wheel in which the water ſtrikes at a certain point below the ſurface of the head, and after that deſcends the arch of a circle, preſſing by its gravity upon the wheel, the effect of ſuch a wheel will be equal to that of an underſhot whoſe head is equal to the difference of level between the ſurface of the water in the reſervoir and the point where it ſtrikes the wheel, added to that of an overſhot, whoſe height is equal to the difference of level between the point where it ſtrikes the wheel and the level of the tail-water.

66
Diſpute concerning Sir Iſaac Newton's doctrine of motion conſidered.

In the 66th volume of the Tranſactions, our author conſiders ſome of the cauſes which have produced diſagreements and diſputes among mathematicians upon this ſubject. He obſerves, that ſoon after Sir Iſaac Newton had given his definition. "that the quantity of motion is the meaſure of the ſame, ariſing from the velocity and quantity of matter conjointly," it was controverted by his cotemporary philoſophers. They maintained, that the meaſure of the quantity of motion ſhould be eſtimated by taking the quantity of matter and the ſquare of the velocity conjointly. On this ſubject he remarks, that from equal impelling powers acting for equal intervals of time, equal augmentations of velocity are acquired by given bodies when they are not reſiſted by a medium. Thus a body deſcending one ſecond by the force of gravity paſſes through a ſpace of 16 feet and an inch; but at the end of that time it has acquired a velocity of 32, feet 2 inches in a ſecond; and the end of two ſeconds it has acquired one that would carry it through 64 feet 4 inches in a ſecond. If, therefore, in conſequence of this equal increaſe of velocity, we define this to be a double quantity of motion generated in a given time in a certain quantity of matter, we come near to Sir Iſaac's definition: but in trying experiments upon the effects of bodies, it appears that when a body is put in motion by whatever cauſe, the impreſſion it will make upon an uniformly reſiſting medium, or upon uniformly yielding ſubſtances, will be as the maſs of matter of the moving body multiplied by the ſquare of its velocity. The queſtion therefore properly is whether thoſe terms, the *quantity of motion*, the *momenta*, or *forces* of bodies in motion, are to be eſteemed equal, double, or triple, when they have been generated by an equable impulſe acting for an equal, double, or triple time? or that it ſhould be meaſured by the effects being equal, double, or triple, in overcoming reſiſtances before a body in motion can be ſtopped? For according to the meaning we put upon theſe words, the momenta of equal bodies will be as the velocities or ſquares of the velocities of the moving bodies.

Though by a proper attention to the terms employed, however, we will find both theſe doctrines to be true; it is certain that ſome of the moſt celebrated writers upon mechanics have fallen into errors by neglecting to attend to the meaning of the terms they make uſe of. Deſaguliers, for inſtance, after having been at pains to ſhow that the diſpute, which in his time had ſubſiſted for 50 years, was a diſpute merely about words, tells us, that both opinions may be eaſily reconciled in the following caſe, viz, that the wheel of an underſhot water-mill is capable of doing quadruple work when the velocity of the water is doubled, inſtead of double work only; "For (ſays he) the adjutage being the ſame, we find, that as the water's velocity is double, there are twice the number of particles that iſſue out, and therefore the ladle-board is ſtruck by twice the matter: which matter moving with twice the velocity that it had in the firſt caſe, the whole effect muſt be quadruple, though the inſtantaneous ſtroke of each particle is increaſed only in a ſimple proportion of the velocity." In another place the ſame author tells us, that though "the knowledge of the foregoing particulars is abſolutely neceſſary for ſetting an underſhot wheel to work, yet the advantage to be reaped from it would be ſtill gueſswork: and we ſhould be at a loſs to find out the utmoſt that it could perform, had it not been for an ingenious propoſition of that excellent mechanic M. Parent of the royal Academy of Sciences, who has ſhowed that an underſhot wheel can do the moſt work, when its velocity is equal to the third part of that of the water; becauſe then two-thirds of the water is employed in driving the wheel, with a force proportionable to the ſquare of the velocity. By multiplying the ſurface of the adjutage or opening by the height of the water, we ſhall have the column of water that moves the wheel. The wheel thus moved will ſuſtain on the oppoſite ſide only four-ninths of that weight which will keep it in equilibrio; but what it can move with the velocity it has, is only one-third of the equilibrium." This concluſion is likewiſe adopted by Mr Macluarin.

67
Enormous miſtakes of Belidor and others.

Underſhot wheels had been greatly preferred by M. Belidor to thoſe of any other conſtruction. He had even concluded, the water applied in this way will do more than ſix times the work of an overſhot wheel; while Dr Deſaguliers, in overthrowing Belidor's propoſition, determined that an overſhot wheel would do 10 times the work of an underſhot wheel with an equal quantity of water. Between theſe two celebrated authors, therefore, there is a difference of leſs than 60 to 1.

In conſequence of ſuch monſtrous diſagreement, Mr Smeaton begun the experiments of which we have already given an account. From them, beſides the poſitions already deduced, it appears, that where the velocity of water is double,, the adjutage or aperture of the ſluice remaining the ſame, the effect is eight times: that is, not as the ſquare, but as the cube of the velocity. In the other concluſion of Deſagulers and Maculaurin, the error was no leſs; for from hence it would follow, that by means of the wheel only $\frac{4}{27}$ths of the water expended would be raiſed back again to the height of the reſervoir form which it deſcended, excluſive of the friction, which would ſtill diminiſh the quantity; but from Mr Smeaton's experiments it appears, that in ſome caſes upwards of one-fourth had been raiſed. In large works the effects had been ſtill greater, approaching in an underſhot wheel to one half, and in an overſhot one to the whole; which would be the limit, if it were poſſible to remove the friction and reſiſtance of the air. The velocity of the wheel alſo, which, according to the concluſions of M. Parent and Mr Deſaguliers, amounted to no more than one-third of the velocity of the water

ter, varies, according to Mr Smeaton, between one-third and one-half. But in all great works the maximum lieth much nearer to one-half than a third; the former appearing to be the true maximum, if all friction, reſiſtance of the air, and ſcattering of water, could be avoided.

To make theſe matters plain to mechanics, and to prevent them from running into practical errors in conſequence of a fallacious theory, Mr Smeaton, in the year 1759, inſtituted another ſet of experiments; the immediate object of which was, to determine what proportion or quantity of mechanical power is expended in giving the ſame body different degrees of velocity. Having conſtructed a proper apparatus for the purpoſe, and with it made a number of experiments, he concludes, "that time, properly ſpeaking, has nothing to do with the production of mechanical effects otherwiſe than as by equally flowing it becomes a common meaſure; ſo that whatever mechanical effect is found to be produced in a given time, the uniform continuance of the action of the ſame mechanical power will, in a double time, produce twice that effect. A mechanical power, therefore, properly ſpeaking, is meaſured by the whole of its mechanical effects produced, whether that effect be produced in a greater or leſſer time: thus, having treaſured up 1000 tuns of water, which I can let out upon the overſhoot wheel of a mill, and deſcending through a perpendicular of 20 feet; this power, applied in a proper manner, will grind certain a quantity of corn in an hour: but ſuppoſing the mill to be capable of receiving a greater impulſe with as great advantage as a leſſer; then, if the water be let out twice as faſt, the ſame quantity of corn will be ground in half an hour, the whole of the water being likewiſe expended in that time. What time has therefore to do in the caſe is this: let the rate of doing the buſineſs or producing the effect be what it will; if this rate is uniform, when I have found by experiment what is done in a given time, then, proceeding at the ſame rate, twice the effect will be produced in twice the time, on ſuppoſition that I have a ſupply of mechanic power to go on with. Thus, 1000 tons of water deſcending through 20 feet. perpendicular, being, as has been ſhown, a given mechanic power, let it be expended at what rate it will; if, when this is expended, we are to wait another hour till an equal quantity can be procured, then we can only expend 12 ſuch quantities in 24 hours. But if, while the thouſand tons of water are expending in one hour, the ſame quantity is renewed, we can then expend 24 ſuch in the 24 hours, or go on without intermiſſion. The product or effect will then be in proportion to time, which is the common meaſure; but the quantity of mechanic power ariſing from the flow of the two rivers, compared by taking an equal portion of time, is double in the one to the other; though each has a mill that, when going, will grind an equal quantity of corn in an hour."

Mr Ferguſon, in his directions to mill-wrights, has adopted the maxim which Mr Smeaton condemns as erroneous, viz. that when the velocity of the wheel is but one-third of that of the water, it then acts to the greateſt advantage. He adds, that the mill-ſtone ought to make about 60 turns in a minute; for when it makes only 40 or 50 turns it grinds too ſlowly; and when more than 70, it heats the meal too much, and cuts the bran ſo ſmall, that a part of it mixes with the meal and cannot be ſeparated from it by any means. The utmoſt perfection of mill-work, therefore, according to this author, lies in making the train ſo that the mill-ſtone ſhall make about 60 turns in a minute, when the wheel moves with one-third of the velocity of the water. To accompliſh this he lays down the following rules. 1. Meaſure the perpendicular height of the fall of water above the middle of the aperture, where it is let out to act by impulſe againſt the float-boards on the lower ſide of the underſhot wheel. 2. Multiply this conſtant number 64.2882 by the height of the fall in feet, and extract the ſquare-root of the product, which will give the number of feet that the water moves in a ſecond. 3. The velocity of the floats of the wheel is equal to one third-of the velocity of the water juſt now found. 4. Divide the circumference of the wheel by the velocity of its floats, and the quotient will be the number of ſeconds in one turn of the great water-wheel, on whoſe axis the cog-wheel that turns the trundle is fixed. 5. Divide 60 by the number of ſeconds in a turn of the water-wheel, and the quotient will be the number of turns it makes in a minute. 6. By this number of turns divide 60, the number of times that a mill-ſtone ought to have in a minute; the quotient is the number of turns that the mill-ſtone ought to make for every one of the large wheel. 7. Then as the number of turns required of the mill-ſtone in a minute is to the number of turns of the cog-wheel in a minute; ſo muſt the number of cogs in the wheel be to the number of ſtaves in the trundle on the axis of the mill-ſtone, in the neareſt whole number that can be found.

On theſe principles Mr Ferguſon has conſtructed the following table, for the ſake of ſuch as have occaſion to conſtruct mills, and are not willing to take the trouble of particular calculations.

The Mill-wright's Table.

Height of the fall of water.	Velocity of the fall of water per ſecond.		Velocity of the wheel per ſecond.		Revolutions of the wheel per minute.		Revolution of the millſtone for one of the wheel		Cogs in the wheel, and ſtaves in the trundle.		Revolutions of the milſtone per-minute by theſe ſtaves and cogs.	
Feet.	Feet.	100 parts of a foot.	Feet.	100 parts of a foot.	Revolutions.	100 parts of a rev.	Revolutions.	100 parts of a rev.	Cogs.	Staves.	Revolutions.	100 parts of a rev.
1	8	02	2	67	2	83	42	40	254	6	119	84
2	11	34	3	78	4	00	30	00	210	7	120	00
3	13	89	4	63	4	91	24	44	196	8	120	28
4	16	04	5	35	5	67	21	16	190	9	119	74
5	17	93	5	98	6	34	18	92	170	9	119	68
6	19	64	6	55	6	94	17	28	156	9	120	20
7	21	21	7	07	7	50	16	00	144	9	120	00
8	22	68	7	56	8	02	14	96	134	9	119	34
9	24	05	8	02	8	51	14	10	140	10	119	14
10	25	35	8	45	8	97	13	38	134	10	120	18
11	26	59	8	86	9	40	12	76	128	10	120	32
12	27	77	9	26	9	82	12	22	122	10	119	80
13	28	91	9	64	10	22	11	74	118	10	120	36
14	30	00	10	00	10	60	11	32	112	10	118	72
15	31	05	10	35	10	99	10	92	110	10	120	96
16	32	07	10	09	11	34	10	58	106	10	120	20
17	33	06	11	02	11	70	10	26	102	10	119	34
18	34	02	11	34	12	02	9	98	100	10	120	20
19	34	95	11	65	12	37	9	70	98	10	121	22
20	35	86	11	95	12	68	9	46	94	10	119	18
1	2		3		4		5		6		7	

66
Imiſon's practical rules for the conſtruction of mills,

For the practical conſtruction of water-mills, Mr Imiſon hath laid down the following rules.

1. To find the velocity or force of any moderate ſtream of water; let it be obſtructed by a dam in ſuch a manner to force the whole ſtream into a ſpout by which it may be conveyed into a large veſſel or reſervoir. Meaſure then the quantity of water which falls into the reſervoir in one ſecond or minute; and multiplying by the number of ſeconds or minutes in an hour, we have the whole force of the ſtream of water *per* hour. In ſtreams which are too large to be meaſured in this way, the velocity is determined (though we muſt own in a vague manner) by that of ſtraw or other light body floating down it; and calculations may be made accordingly.

Mr Imiſon differs very materially from Mr Ferguſon in the number of revolutions which a mill-ſtone ought to make in a minute; the latter, as has been already mentioned, being of opinion, that 60 revolutions of a mill-ſtone in a minute are ſufficient, while Mr Imiſon requires 120; though he agrees with him that the velocity of the wheel ſhould be only one-third of that of the water. The mill-ſtone, according to Mr Ferguſon, onght to be five feet in diameter; but Mr Imiſon makes it only four feet and an half.

To conſtruct a mill by this table, find the height of the fall of water in the firſt column, and againſt that height in the ſixth column you have the number of cogs in the wheel and ſtaves in the trundle for cauſing the millſtone 4 feet 6 inches diameter to make about 120 revolutions in a minute, as near as poſſible, when the wheel goes with one-third part of the velocity of the water. And it appears by the 7th column, that the number of cogs in the wheel and ſtaves in the trundle are ſo near the truth for the required purpoſe, that the leaſt number of revolutions of the mill-ſtone in a minute is 118, and the greateſt number never exceeds 121; which, according to our author, is the velocity of the beſt mills he had ſeen.

With regard to the mere mechanical part, our author obſerves, that an overſhot wheel acts with greater power than a breaſt or underſhot wheel; ſo that where there is a conſiderable deſcent, and only a ſmall quantity of water, the overſhot wheel ought always to be made uſe of. Where the water runs only upon a little declivity, it can act but ſlowly upon the under part of the

the wheel; in which caſe, the motion of the wheel will be very ſlow: the float-boards therefore ought to be very long, though not high, that a large body of water may act upon them; ſo that what is wanting in velocity may be made up in power: in which caſe, the cog wheel may have a greater number of cogs in proportion to the ſtaves of the trundle, in order to give the mill-ſtone a ſufficient degree of velocity.

For the conſtruction of the different parts of mills, Mr Imiſon gives the following general directions:

Fig. 96.

The method for ſetting out a ſpur-wheel and wallower.—Draw the pitch lines A1, B1, A2, 2B; then divide them into the number of teeth or cogs required, as *abc*.

Divide one of thoſe diſtances, as *bc*, into ſeven equal parts, as 1, 2, 3, 4, 5, 6, 7: three parts allow for the thickneſs of the cogs, as 1, 2, 3, in the cog *a*, and four for the thickneſs of the ſtave, of the wallower (one reaſon for allowing three parts for the cog and four for the ſtave, is, the wallower is in general of leſs diameter than the wheel, therefore ſubject to more wear in proportion of the number of cogs to the number of ſtaves; but if there is the ſame number of ſtaves as of cogs, they may be of equal thickneſs), as 1, 2, 3, 4, in the ſtave *m*, fig. 97. the height of the cog is equal to four parts; then divide its height into five equal parts, as 1, 2, 3, 4, 5, in the cog C; allow three for the bottom to the pitch line of the cog; the other two parts for epicycloid, ſo as to fit and bear on the ſtave equally. The mill-wrights in general put the point of a pair of compaſſes in the dot 3, of the cog *a*, and ſtrike the line *de*; then remove the point of the compaſſes to the point *d*, and ſtrike the curve line 3*f*, which they account near enough the figure of the epicycloid.

The method for a face-wheel is thus: Divide the pitch line AB into the number of cogs intended, as *abc*; divide the diſtance *bc* into ſeven equal parts; three of thoſe parts allow for the thickneſs of the cogs, as 1, 2, 3, in the cog *a*, four for the height and four for the width, as *de*, and four for the thickneſs of the ſtave *m*; draw a line through the centre of the cog, as the line AI at S: and on the point 5 deſcribe the line *de*; remove the compaſſes to the point A, and draw the line *fg*, which forms the ſhape of the cog; then ſhape the cog on the ſides to a cycloid, as *defg*. But this method of ſetting out the ſhape of a cog is variable, according to the cycloid in different diameters of wheels.

In common ſpur-nuts, divide the pitch line A into twice as many equal parts as you intend teeth, as *a*, *b*, *c*, *d*, *e*, fig. 98.; with a pair of compaſſes open to half the diſtance of any of thoſe diviſions, from the points *a*1, *c*3, *e*5, draw the ſemicircles *a*, *c*, and *e* which will form the ends of the teeth. From the points 2, 4, and 6, draw the ſemicircles *ghi*, which will form the hollow curves for the ſpaces; but if the ends of the teeth were epicycloids, inſtead of ſemicircles, they would act much better.

Fig. 99.

The principle of bevel geer,—conſiſts in two cones, rolling on the ſurface of each other, as the cone A and B revolving on their centres *ab*, *ac*; if their baſes are equal, they will perform their revolutions in one and the ſame time, or any other two points equally diſtant from the centre *a*, as *d*1, *d*2, *d*3, &c. will revolve in the ſame time as *f*1, *f*2, *f*3, &c. In the like manner, if the cones *afde* be twice the diameters at the baſe *de*, as the cones *afe* are; then if they turn about their centres, when the cone *afd* has made one revolution, the cone *ade* will have but one half a revolution; or when *afd* has made two revolutions, *ade* will have made but one, and every part equally diſtant from the centre *a*, as *f*1, *f*2, *f*3, &c. will have made two revolutions to *e*1, *e*2, *e*3, &c. and if the cones were fluted, or had teeth cut in them, diverging from the centre *a* to the baſes *de*, *ef*, they would then become bevel geer. The teeth at the point of the cone being ſmall and of little uſe may be cut off at E and F, figs. 102, 103. as ſeen by fig. 104. where the upright ſhaft *ab*, with the bevel wheel *cd*, turns the bevel wheel *ef* with its ſhaft *bg*, and the teeth work freely into each other, as *ab*, fig. 105. The teeth may be made of any dimenſion, according to the ſtrength required; and this method will enable them to overcome a much greater reſiſtance, and work ſmoother than a face wheel and wallower of the common form can poſſibly do; beſides it is of great uſe to convey a motion in any direction, or to any part of a building, with the leaſt trouble and friction.

Plates CCLXXXIX, CCXC. fig. 100, 101.

Plate CCXC.

Fig. 106.

The method of conveying motion in any direction, and proportioning or ſhaping the wheels thereto, is as follows: let the line *ab* repreſent a ſhaft coming from a wheel; draw the line *ed* to interſect the line *ab*, in the direction that the motion to be conveyed is intended, which will now repreſent a ſhaft to the intended motion.

Again, ſuppoſe the ſhaft *ed* is to revolve three times, while the ſhaft *ab* revolves once, draw the parallel line *ii*, at any diſtance not too great, ſuppoſe one foot by a ſcale; then draw the parallel line *kk* at three feet diſtance, after which draw the dotted line *w*X, through the interſection of the ſhafts *ab* and *ed*, and likewiſe through the interſection of the parallel lines *ii* and *kk*, in the points X and *y*; which will be the pitch line of the two bevel wheels, or the line where the teeth of the two wheels act on each other, as may be ſeen fig. 107. where the motion may be conveyed in any direction.

The univerſal joint, as repreſented fig. 108. may be applied to communicate motion inſtead of bevel geer, where the ſpeed is to be continued the ſame, and where the angle does not exceed 30 or 40 degrees, and the equality of motion is not regarded; for as it recedes from a right line, its motion becomes more irregular. This joint may be conſtructed by a croſs, as repreſented in the figure; or with four pins faſtened at right angles upon the circumference of a hoop or ſolid ball. It is of great uſe in cotton-mills, where the tumbling ſhafts are continued to a great diſtance from the moving power. But by applying this joint, the ſhafts may be cut into convenient lengths, by which it will be enabled to overcome greater reſiſtance.

Fig. 109.

To deſcribe the cycloid and epicycloid, of uſe in ſhaping the teeth of wheels, &c.—If a point or pencil *a* on the circumference of the circle B proceeds along the plane *a*C in a right line, and at the ſame time revolves round its centre, it will deſcribe a cycloid.

Fig. 110.

And if the generating circle D moves along the circumference of another circle E, and at the ſame time turns round its centre, the point of contact will deſcribe an epicycloid.

In the conſtruction of wind-mills, Mr Smeaton has been at no leſs pains to explain the principles than in thoſe which go by water. For this purpoſe he conſtructed a machine, of which a particular deſcription is given in the 51ſt volume of the Philoſophical Tranſactions. The general principle of this was, that by means of a determinate weight it carried round an axis with an horizontal arm, upon which were four ſmall moveable ſails. Thus the ſails met with a conſtant and equable blaſt of air; and as they moved round, a ſtring with a weight affixed to it was wound about their axis, and thus ſhowed what kind of ſize or conſtruction of ſails anſwered the purpoſe beſt.

With this machine a great number of experiments were made; the reſults of which were as follow.

1. The ſails ſet at the angle with the axis, propoſed as the beſt by M. Parent and other geometricians, *viz.* 55°, was found to be the worſt proportion of any that was tried.

2. When the angle of the ſails with the axis was increaſed from 72° to 75°, the power was augmented in the proportion of 31 to 45; and this is the angle moſt commonly in uſe when the ſails are planes.

3. Were nothing more requiſite than to cauſe the ſails acquire a certain degree of velocity by the wind, the poſition recommended by M. Parent would be the beſt. But if the ſails are intended with given dimenſions, to produce the greateſt effects poſſible in a given time, we muſt, if planes are made uſe of, confine our angle within the limits of 72 and 75 degrees.

4. The variation of a degree or two, when the angle is near the beſt, is but of little conſequence.

5. When the wind falls upon concave ſails, it is an advantage to the power of the whole, though each part ſeparately taken ſhould not be diſpoſed of to the beſt advantage.

6. From ſeveral experiments on a large ſcale, Mr Smeaton has found the following angles to anſwer as well as any. The radius is ſuppoſed to be divided into ſix parts; and ⅙th, reckoning from the centre, is called 1, the extremity being denoted 6.

N°	Angle with that axis.	Angle with the plane of motion.
1	72°	18°
2	71	19
3	72	18 middle
4	74	16
5	77½	12½
6	83	7 extremity.

7. Having thus obtained the beſt method of *weathering* the ſails, *i. e.* the moſt advantageous manner in which they can be placed, our author's next care was to try what advantage could be derived from an increaſe of ſurface upon the ſame radius. The reſult was, that a broader ſail requires a large angle; and when the ſail is broader at the extremity than near the centre, the figure is more advantageous than that of a parallelogram. The figure and proportion of enlarged ſails, which our author determines to be moſt advantageous on a large ſcale, is that where the extreme bar is one-third of the radius or whip (as the workman call it), and is divided by the whip in the proportion of 3 to 5. The triangular or loading ſail is covered with board from the point downward of its height, the reſt as uſual with cloth. The angles abovementioned are likewiſe the moſt proper for enlarged ſails; it being found in practice, that the ſails would rather be too little than too much expoſed to the direct action of the wind.

Some have imagined, that the more ſail the greater would be the power of the windmill, and have therefore propoſed to fill up the whole area; and by making each ſail a ſector of an ellipſis, according to M. Parent's method, to intercept the whole cylinder of wind, in order to produce the greateſt effect poſſible. From our author's experiments, however, it appeared, that when the ſurface of all the ſails exceeded ſeven-eighths of the area, the effect was rather diminiſhed than augmented. Hence he concludes, that when the whole cylinder of wind is intercepted, it cannot then produce the greateſt effect for want of proper interſtices to eſcape.

"It is certainly deſirable (ſays Mr Smeaton), that the ſails of windmills ſhould be as ſhort as poſſible; but it is equally deſirable, that the quantity of cloth ſhould be the leaſt that may be, to avoid damage by ſudden ſqualls of wind. The beſt ſtructure, therefore, for large mills, is that where the quantity of cloth is the greateſt in a given circle that can be: on this condition, that the effect holds out in proportion to the quantity of cloth; for otherwiſe the effect can be augmented in a given degree by a leſſer increaſe of cloth upon a larger radius, than would be required if the cloth was increaſed upon the ſame radius.

8. The ratios between the velocities of windmill ſails unloaded, and when loaded to their maximum, turned out very different in different experiments, but the moſt common proportion was as 3 to 2. In general it happened, that where the power was greateſt, whether by an enlargement of the ſurface of the ſails, or an increaſed velocity of the wind, the ſecond term of the ratio was diminiſhed.

9. The ratios between the leaſt load that would ſtop the ſails and the maximum with which they would turn, were confined betwixt that of 10 to 8 and 10 to 9; being at a medium about 10 to 8.3, and 10 to 9, or about 6 to 5; though on the whole it appeared, that where the angle of the ſails or quantity of cloth was greateſt, the ſecond term of the ratio was leſs.

10. The velocity of windmill ſails, whether unloaded or loaded, ſo as to produce a maximum, is nearly as the velocity of the wind, their ſhape and poſition being the ſame. On this ſubject Mr Ferguſon remarks, that it is almoſt incredible to think with what velocity the tips of the ſails move when acted upon by a moderate wind. He has ſeveral times counted the number of revolutions made by the ſails in 10 or 15 minutes; and from the length of the arms from tip to tip, has computed, that if an hoop of the ſame ſize was to run upon plain ground with an equal velocity, it would go upwards of 30 miles in an hour.

11. The load at the maximum is nearly, but ſomewhat leſs, than as the ſquare of the velocity of the wind; the ſhape and poſition of the ſails being the ſame.

12. The effects of the ſame ſails at a maximum are nearly, but ſomewhat leſs, than as the cubes of the velocity of the wind.

13. The load of the ſame ſails at a maximum is nearly

nearly as the ſquares, and the effect as the cubes of their number of turns in a given time.

14. When ſails are loaded ſo as to produce a maximum at a given velocity, and the velocity of the wind increaſes, the load continuing the ſame; then the increaſe of effect, when the increaſe of the velocity of the wind is ſmall, will be nearly as the ſquares of theſe velocities; but when the velocity of the wind is double, the effects will be nearly as 10 to $27\frac{1}{2}$; and when the velocities compared are more than double of that where the given load produces a maximum, the effects increaſe nearly in a ſimple ratio of the velocity of the wind. Hence our author concludes, that windmills, ſuch as the different ſpecies for draining water, &c. loſe much of their effect by acting againſt one invariable oppoſition.

15. In ſails of a ſimilar figure and poſition, the number of turns in a given time will be reciprocally as the radius or length of the ſail.

16. The load at a maximum that ſails of a ſimilar figure and poſition will overcome, at a given diſtance from the centre of motion, will be as the cube of the radius.

17. The effects of ſails of ſimilar poſition and figure are as the ſquare of the radius. Hence augmenting the length of the ſail without augmenting the quantity of cloth, does not increaſe the power; becauſe what is gained by the length of the lever is loſt by the ſlowneſs of the motion. Hence alſo if the ſails are increaſed in length, the breadth remaining the ſame, the effect will be as the radius.

18. The velocity of the extremities of the Dutch ſails, as well as of the enlarged ſails, either unloaded or even when loaded to a maximum, is conſiderably greater than that of the wind itſelf. This appears plainly from the obſervations of Mr Ferguſon already related concerning the velocity of ſails, and is more fully treated of under the article Wind.

19. From many obſervations of the comparative effects of ſails of various kinds, Mr Smeaton concludes, that the enlarged ſails are ſuperior to thoſe of the Dutch conſtruction.

Having thus diſcuſſed the ſubject of the common windmills with oblique vanes, our author next proceeds to the conſideration of thoſe called *horizontal* windmills, in which it is attempted to make the wind impinge directly upon the wheel, as in the caſe of watermills. To ſet the probable advantage of this ſcheme in its proper point of view, Mr Smeaton proceeds in the following manner: Let AB, fig. 111. be the ſection of a plane, in which let the wind blow in the direction CD, with ſuch a velocity as to deſcribe a given ſpace BE, in a given time, ſuppoſe one ſecond; and let AB be moved parallel to itſelf in the direction CD. Now, if the plane AB moves with the ſame velocity as the wind; that is, if the point B moves through the ſpace BE in the ſame time that a particle of air would move through it, it is plain, that in this caſe there can be no preſſure or impulſe of the wind upon the plane; but if the plane moves ſlower than the wind, ſo that the point B may move to F, while a particle of air ſetting out from B would reach E, then BF will expreſs the velocity of the plane; and the relative velocity of the wind and plane would be expreſſed by the line FE. Let the ratio of FE to BE be given, ſuppoſe 2 to 3; let the line AB repreſent the impulſe of the wind upon the plane AB when acting with its whole velocity BE; but when acting with its relative velocity FE, let its impulſe be denoted by ſome aliquot part of AB, as for inſtance $\frac{4}{9}$; then will $\frac{4}{9}$ths of the parallelogram AF repreſent the mechanical power of the plane, that is, $\frac{4}{9}$ths AB$\times\frac{1}{3}$BE.

" 2. Let IN be the ſection of a plane inclined in ſuch a manner that the baſe IK of the right angled triangle IKN may be equal to AB; and the perpendicular NK=BE: let the plane IN be ſtruck by the wind in the direction LM, perpendicular to IK; then, according to the known rules of oblique forces, the impulſe of the wind upon the plain IN, tending to move it according to the direction LM or NK, will be denoted by the baſe IK; and that part of the impulſe tending to move it, according to the direction IK, will be expreſſed by the perpendicular NK. Let the plane IN be moveable in the direction of IK only; that is, the point I in the direction of IK, and the point N in the direction NQ parallel thereto. Now it is evident, that if the point I moves through the line IK, while a particle of air, ſetting forwards at the ſame time from the point N, moves through the line NK, they will both arrive at the point K at the ſame time; and conſequently there can be no preſſure or impulſe of the particle of air upon the plane IN. Now let IO be to IK as BF to BE; and let the plane IN move at ſuch a rate, that the point I may arrive at O, and acquire the poſition OQ, in the ſame time that a particle of air would move through the ſpace NK; as OQ is parallel to IN, by the properties of ſimilar triangles, it will cut NK in the point P in ſuch a manner, that NP will be equal to BF, and PK to FE. Hence it appears, that the plane IN, by acquiring the poſition OQ, withdraws itſelf from the action of the wind by the ſame ſpace NP that the plane AB does by acquiring the poſition FG; and conſequently, from the equality of PK to FE, the relative impulſe of the wind PK upon the plane OQ will be equal to the relative impulſe of the wind upon the plane FG: and ſince the impulſe of the wind upon AB, with the relative velocity FE, in the direction BE, is repreſented by $\frac{4}{9}$ AB; the relative impulſe of the wind upon the plane IN in the direction NK will in like manner be repreſented by $\frac{4}{9}$ IK; and the impulſe of the wind upon the plane IN, with the relative velocity PK, in the direction IK will be repreſented by $\frac{4}{9}$ NK: and conſequently the mechanical power of the plane IN in the direction IK will be repreſented by $\frac{4}{9}$ of the parallelogram IQ; that is, $\frac{1}{3}$ IK$\times\frac{4}{9}$NK: that is, from the equality of IK to AB, and NK to BE, we ſhall have $\frac{4}{9}$IQ$=\frac{1}{3}$AB$\times\frac{4}{9}$BE$=\frac{4}{9}$AB$\times\frac{1}{3}$BE$=\frac{4}{9}$ the area of the parallelogram AF.

" Hence we deduce this general propoſition; that all planes, however ſituated, that intercept the ſame ſection of the wind, and having the ſame relative velocity in regard to the wind, when reduced into the ſame direction, have equal powers to produce the ſame mechanical effects. For what is loſt by the obliquity of the impulſe, is gained by the velocity of the motion.

" Hence it appears, that an oblique ſail is under no diſadvantage in reſpect of power, compared with a direct one; except what ariſes from a diminution of its breadth,

breadth, in regard to the ſection of the wind; the breadth IN being by obliquity reduced to IK.

"The diſadvantage of horizontal windmills therefore does not conſiſt in this, that each ſail, when directly expoſed to the wind, is capable of a leſs power than an oblique one of the ſame dimenſions; but that in an horizontal windmill little more than one ſail can be acting at once: whereas, in the common windmill, all the four act together; and therefore ſuppoſing each vane of an horizontal windmill to be of the ſame ſize with that of a vertical one, it is manifeſt that the power of a vertical mill will be four times as great as that of an horizontal one, let the number of vanes be what we will. This diſadvantage ariſes from the nature of the thing; but if we conſider the further diſadvantage that ariſes from the difficulty of getting the ſails back again againſt the winds, &c. we need not wonder if this kind of mill is in reality found to have not above one-eighth or one tenth of the power of the common ſort; as has appeared in ſome attempts of this kind."

Notwithſtanding what is here advanced, it ſeems that the ideas of Mr Smeaton have not been very generally received, as premiums are ſtill held forth for the beſt methods of conſtructing horizontal windmills. Indeed, conſidering the clearneſs and perſpicuity of the above reaſoning, it ſeems ſurpriſing that public encouragement ſhould continue to be given to attempts which muſt certainly prove abortive. The principal inconvenience in wind-mills is their exceſſive irregularity and difficulty of being managed when the wind is high, owing to the great extent of the ſails and bulk of the machinery. But were it poſſible to make a number of ſmall wind-mills exert their power upon one object, theſe would be much more eaſily managed than one large one. Perhaps if a number of theſe were to be employed in pumping up water to a certain height from a lake or reſervoir, ſo as to produce a conſtant ſtream of water to turn a common mill, it might be more advantageous than to employ them directly. Windmills are commonly erected upon eminences for the ſake of receiving the wind to more advantage; and there are few eminences which do not afford a ſmall ſupply of water at no great diſtance from their ſummit. This ſupply being collected in a reſervoir, might be drawn up to the top by pumps worked by wind-mills; where being collected in another reſervoir, it might be let down to the former, turning a water-mill in its way, and being again drawn up by the pumps as before.

Some projectors conſidering the great power of oblique vanes in wind-mills, have attempted to improve water-mills by giving them oblique vanes, but with as little ſucceſs. The power of the ſame ſection of a ſtream of water is not greater when acting upon an oblique vane than on a direct one; and any advantage which can be made of intercepting a greater ſection of water, which ſometimes may be done in the caſe of an open river, muſt be counterbalanced by the ſuperior reſiſtance that ſuch vanes would meet with by moving at right angles to the current: whereas the common floats always move with the water nearly in the ſame direction.

Mr Smeaton concludes his diſſertation upon this ſubject, with giving a reaſon why one angle ſhould be preferable to another in ſetting the ſails of a wind-mill. "It is to be obſerved (ſays he), that if the breadth of the ſail IN is given, the greater the angle KIN, the leſs will be the baſe IK; that is, the ſection of the wind intercepted will be leſs. On the other hand, the more acute the angle KIN, the leſs will be the perpendicular KN; that is, the impulſe of the wind in the direction IK being leſs, and the velocity of the ſail greater, the reſiſtance of the medium will be greater alſo. Hence, therefore, as there is a diminution of the ſection of the wind intercepted on one hand, and an increaſe of reſiſtance on the other, there is ſome angle where the diſadvantage ariſing from theſe cauſes upon the whole is the leaſt of all; but as the diſadvantage ariſing from reſiſtance is more of a phyſical than geometrical conſideration, the true angle will beſt be aſſigned by experiment."

SECT. VI. *Of the Motion of Bodies in Straight Lines and Curves; the Acceleration, Accumulation, and Retardation, of Motion in various Circumſtances.*

To underſtand this ſubject, it is neceſſary to keep in mind what has been ſaid concerning the *momentum* or quantity of motion in any moving body, *viz.* that it is compounded of the velocity multiplied into the quantity of matter. Thus, ſuppoſe there are two bodies, one containing twice the quantity of matter contained in the other, but moving with thrice its velocity, the quantities of matter will be expreſſed by any numbers in the proportion of 2 to 1, and their velocities by any others in the proportion of 3 to 1. Multiplying therefore the quantity of matter in the firſt (2) by its velocity (3), the product is 6; and multiplying the quantity of matter (1) by its velocity (1), the product is only 1; whence it appears that the momenta or abſolute forces of theſe bodies are to one another as 6 to 1.

As ſome bodies are elaſtic and others non-elaſtic, the effect of motion communicated from one to another becomes very different, according to this circumſtance. The motion is likewiſe very different, according to the manner in which one body acts upon another, and according to which it will be driven forward in a rectilinear direction, or deſcribe curves of various kinds, revolving on its axis, &c. Theſe different kinds of motion have been conſidered by different authors, but by none more particularly than by Mr G. Atwood, who has publiſhed a large octavo volume upon the rectilinear motion and rotation of bodies. The fundamental laws of motion aſſumed by this author as axioms are three.

1. Every body perſeveres in its ſtate of reſt or uniform motion in a right line, until a change is effected by the agency of ſome external force.
2. Any change effected in the quieſcence or motion of a body is in the direction of the force impreſſed, and is proportional to it in quantity.
3. Action and reaction are equal and in contrary directions.

From theſe three ſimple axioms, the truth of which muſt, from what has been already ſaid, be abundantly evident, our author proceeds to demonſtrate the moſt difficult problems concerning the impulſe and motion of of bodies in every poſſible direction, beginning from the moſt ſimple and eaſy deductions. For the more eaſy comprehending this ſubject, however, we ſhall premiſe what our author has ſaid in his ſecond ſection concerning the properties of *ratios* or proportions.

1. Two mathematical quantities of the ſame kind, as two lines, two ſurfaces, two angles, &c. conſtitute a ratio. Thus, ſuppoſe one line two feet in length and another four: theſe are to one another in the ratio of 4 to 2, or of 2 to 1; but a line cannot be ſaid to bear any ratio to a ſurface, becauſe they are not quantities of the ſame kind, and therefore cannot be compared.

2. We may compare the ratio of two quantities of one kind with the ratio of two quantities of a different kind. Thus, when two bodies move uniformly, for an equal time, but with different velocities, the ratio of the ſpaces paſſed over may be compared with that of the velocities, though ſpace and velocity are accounted different quantities.

3. If any quantity be divided by another of the ſame kind, the quotient becomes abſolute number. Thus, if we divide a velocity of four feet in a ſecond by one of two feet in a ſecond, the quotient will be 2; and in all caſes the quotient will be to 1 as the greater quantity is to the leſſer.

4. The ratio of any mathematical quantities may be expreſſed by two numbers, if both terms of the ratio be divided by the conſequent or by the antecedent. Thus let the antecedent be 8 and the conſequent 4; let both be divided by 4, and the ratio will then be 2 to 1; or let both be divided by 8, and it will be 1 to 0.5, which is the ſame.

5. Any ratio may be repreſented by a fraction, the numerator of which is the antecedent, and the denominator the conſequent. Thus the ratio of 8 to 4 is repreſented by the fraction $\frac{8}{4}$; and hence we may add and ſubtract ratios by the addition and multiplication of fractions. Thus, ſuppoſing two bodies to move uniformly, one at the rate of 8 feet in a ſecond and the other 4; ſuppoſing them alſo to move the former for four, and the latter for two ſeconds, the ſpaces paſſed over will be 32 and 8, their ratio $\frac{32}{8}$, or at length $32:8:4\times8:2\times4$; or $\frac{32}{8}=\frac{4}{2}\times\frac{8}{4}$. Here it is to be obſerved, that when the mark of equality is interpoſed betwixt heterogeneous quantities, the only equality meant, is that which ſubſiſts between the ratios there expreſſed; and when the mark of multiplication is interpoſed between heterogeneous quantities, it means the addition of two ratios, the antecedents of which are the terms expreſſed, and the conſequents are unity.

6. If there are three ratios, conſiſting of variable terms, and the relation of the quantities to each other be ſuch, that when the third ratio becomes unity the other two become equal; or when the ſecond becomes unity, the firſt and third are equal; then in all caſes, whatever be the magnitudes, we have the firſt ratio= the 2d×3d. Thus let the three ratios be $\frac{5}{2}$, $\frac{7}{3}$, and $\frac{2}{1}$, diminiſhing the numbers by 1, we have $\frac{4}{2}$, $\frac{6}{3}$, and $\frac{1}{1}$, it is evident that $\frac{4}{2}=\frac{6}{3}\times\frac{1}{1}$: the ſame will be the caſe if we place them in a different order, as $\frac{5}{2}$, $\frac{2}{1}$, and $\frac{7}{3}$; for then, diminiſhing as before, we have $\frac{4}{2}$, $\frac{1}{1}$, and $\frac{6}{3}$, in which caſe $\frac{4}{2}\frac{1}{1}=\frac{1}{1}\times\frac{6}{3}$.

7. In comparing the ratios which obtain between mathematical quantities of any ſort, the ſtandard to which each of thoſe quantities is referred may be taken =1. Thus, ſuppoſing we compare the weight, magnitude, and denſity, of any ſubſtance with water, we may take a cubic inch of that element for a ſtandard, and call the weight, magnitude, and denſity of it =1; by which means we may readily compare the weight, magnitude, or denſity, of any quantity, however large, of another ſubſtance with water.

We now proceed to that part of the work which treats directly of the motion of bodies acted upon by any external impulſe.

8. Any force acting continually upon a body in the ſame direction, will produce a continual acceleration or retardation of the motion. Thus, if a body deſcends by the force of gravity, its motion is continually accelerated; or if it be thrown up againſt the force of gravity, the motion will be continually retarded until it be totally deſtroyed.

9. If, while a body moves, equal quantities of motion be communicated to it, or taken from it in equal ſpaces of time, the force is ſaid to be conſtant, and equally accelerated or retarded.

10. When unequal velocities are generated or deſtroyed in equal ſpaces of time, the force is ſaid to be variable.

11. When a body is acted upon by a conſtant force, we muſt conſider the ſpace through which it moves, the time it takes to move through it, the velocity it acquires, and the force which produces it; any two of which being given, we may from them find the other two. Here we muſt obſerve, that the force mentioned relates only to the communication of the velocity, without any regard to the quantities of matter moved. As it is proportioned to the velocity generated in a given time, it is thence called the *accelerating* force. That which relates to the quantity of matter moved, as well as the velocity communicated, is called the *moving* force: being proportional to the quantity of motion produced in a given time.

12. The moving forces which communicate the ſame velocity in a given time to different bodies, will be as the quantities of matter contained in the bodies moved. This will appear from a conſideration of what has already been ſaid concerning the momenta of bodies. For if one body contains ten times the quantity of matter that another does, it will of courſe require ten times as much force to move it with an equal degree of velocity; for the former is equivalent to ten ſuch bodies, and it is the ſame thing whether they be ſeparate or altogether.

13. The moving forces which act upon bodies, and the degrees of velocity communicated to them in a certain time, are proportional to the quantities of matter moved and the velocities communicated jointly: for, by the laſt propoſition, when the velocity communicated in a certain time is the ſame, the moving force is as the quantity of matter moved Thus, if a ball of ten pounds weight is made to move at the rate of 10 feet in a ſecond, and another of one pound is made to move at the ſame rate, the moving forces will be in proportion to the quantities of matter; that is, as 10 to 1. Hence we may eaſily perceive, that when the quantity of matter is given, the moving force will be as the velocity. Thus, if two balls of ten pounds each

each are cauſed to move, one with the velocity of ten feet in a ſecond, and the other with a velocity of five feet in the ſame time, the forces will be as the velocities; that is, as 10 to 5, or as 2 to 1; and hence, when both quantities of matter and velocities are different, the moving forces will be according to theſe jointly. Thus if a ball of ten pounds is moved with a velocity of ten feet in a ſecond, and a ball of one pound moves with a velocity of five feet in a ſecond, the moving forces will be as 10×10 or 100 is to 1×5, or as 20 to 1.

Here our author takes occaſion to deny that there is any ſuch thing as a communication of motion by an inſtantaneous impulſe or ſtroke, as has commonly been ſuppoſed. Every degree of motion, according to him, is the effect of acceleration. “The latter way (ſays he) viz. the communication by inſtantaneous impulſe, can obtain only in bodies perfectly hard and inflexible, which exiſt not in nature; and even in the abſtract conſideration of theſe as well as of other caſes in mechanics, when metaphyſical poſſibilities inſtead of the natural ſtate of bodies are attended to, difficulties ariſe hardly explicable by any method of reaſoning: but it is certain, that when finite velocity is communicated to any natural body, the time in which it is communicated muſt be finite alſo: ſo that when the body acted upon begins to move from quieſcence, it muſt, during the action of the force, poſſeſs all the intermediate degrees of velocity between 0 and the velocity ultimately communicated..

“To exemplify this further, let it be ſuppoſed that a ſoft and flexible ball of clay impinges againſt anothe of the ſame ſort, in the direction of a line joining the centres of the balls. At the firſt inſtant of the impact, the body ſtruck will begin to move, and will proceed with a velocity inferior to that of the impinging body, the velocity of which will continue to decreaſe, and that of the other body to increaſe, as long as the impinging force cauſes a change in the figure of the two bodies; that is, till they have both acquired a common velocity; at which inſtant all acceleration ceaſes if the bodies be perfectly non-elaſtic. If the bodies be of ſuch a kind, as, after having received impreſſion from any impact, poſſeſs a power of reſtoring their changed figure with a force equal to that of the impact, it is manifeſt, that whatever velocity was communicated during the change of figure, an equal quantity will be ſuperadded during the reſtoration of it. In this caſe, after the acceleration ariſing from the impact during the change of the figure of the bodies has ceaſed, the bodies having then acquired a common velocity, a new acceleration will begin, being cauſed by the elaſtic force of the balls, which, acting in a direction of lines joining their centres, tends to ſeparate them, accelerating the ball ſtruck, and retarding the other.

“From theſe conſiderations it appears, that in whatever degree the hardneſs of perfectly elaſtic bodies may differ, the effects of their impact will be the ſame, the weights and velocities before the ſtroke being given. For the figures of the ſtriking and of the other body continually change, till they have acquired a common velocity, which depends only on the velocity of bodies and their impact, and is determined by the rules for the colliſion of non-elaſtic bodies. Moreover, the reſtoration of the changed figures, how great or how ſmall ſoever may have been the change, muſt cauſe an addition of velocity in the ball ſtruck equal to that received from the impact.

“It follows alſo, that the effect will be the ſame, whether the bodies be both perfectly elaſtic, or whether one of them be perfectly elaſtic and the other perfectly hard; every thing elſe being given for the figure of the elaſtic body muſt change until the bodies have obtained a common velocity, which depends on the weights and velocities before the ſtroke only; and will be the ſame as if the bodies were non-elaſtic: the reſtoration of the figure will in this, as well as in the former caſe, cauſe an increaſe of velocity in the ball ſtruck, equal to that before communicated. Although no ſubſtance in nature poſſeſſes perfect elaſticity, or is entirely deſtitute of it, yet there are ſeveral elaſtic and non-elaſtic bodies ſubject to experimental trials, wherein the laws relating to colliſion are found to agree with fact to a conſiderable degree of exactneſs.

14. The accelerating forces which communicate velocity to bodies are directly as the moving forces, and inverſely as the quantity of matter moved; for ſince by prop. 11. the accelerating force is as the velocity generated in a given time; and by prop. 13. the moving force is as the quantity of matter and velocity generated in a given time, it follows, that the moving force is as the accelerating force and quantity of matter moved jointly: that is, the accelerating force is as the moving force directly, and the quantity of matter moved inverſely. Thus, let a maſs of matter, equal to four ounces, be impelled by a force equal to three ounces; then the force which accelerates the maſs of four ounces will be three-fourths when the acceleration of gravity is 1; or in other words, it will generate, in a given time, three parts in four of the velocity which gravity generates during any given time.

15. In bodies impelled in a rectilinear direction by forces acting uniformly, the velocities generated are as the forces and times in which they act, conjointly. Thus, ſuppoſe a force equal to ten acting upon a ball of ten pounds, and another alſo equal to ten acting upon a ball of equal weight, the former for one ſecond, and the latter for two; it is plain that the velocity generated in the latter will be double to that gegenerated in the former. But if we ſuppoſe the latter ball to be acted upon by a force equal only to five, then will both the velocities be equal, though the latter ſhould continue for two ſeconds and the former only for one. In all practical inquiries of this kind, however, it muſt be remarked, that a ſtandard velocity is to be obtained from obſerving what degree of velocity is generated by the force of gravity during a given time; one ſecond, for inſtance.

16. If a quieſcent body be impelled by any conſtant force acting upon it for a given time, the ſpace deſcribed will be to the ſpace deſcribed in the ſame time by a body moving uniformly with the laſt acquired velocity, in the ratio of one to two. In order to underſtand this, we muſt ſuppoſe the time to be divided into ſuch ſmall parts that the acceleration during any one of them is imperceptible: then it is evident, that at the end of two moments, the impulſe continuing the ſame, it will have gained double the velocity it did the firſt moment; and this

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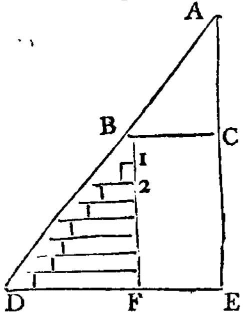
is manifeſt from the phenomena of falling bodies, which having deſcended for one ſecond, acquire then a velocity twice as great as that which they had during the firſt ſecond. That this propoſition may be true, however, it is neceſſary that the velocity of the impelling power ſhould be *infinite* with reſpect to that which the body itſelf can acquire; for whenever the body moved comes to acquire a velocity in any degree proportional to that of the moving power, then that proportion muſt be deducted from the acceleration; and when both come to be equal, no farther acceleration can take place. With regard to falling bodies, indeed, as far as our obſervations can go, were it not for the reſiſtance of the air, this acceleration would go forward till the body had acquired a velocity much ſuperior to any that we can now communicate, either by that or any other method. In all artificial accelerations, however, the velocity of the body moved ſoon becomes equal to that of the moving power, and then the motion goes on uniformly, which otherwiſe would continually increaſe.

17. The ſpaces which bodies deſcribe from reſt, by the action of conſtant forces, are in a compound ratio of the velocities laſt acquired and the times of motion: For the ſpaces deſcribed by the laſt acquired velocities continued uniform, are as thoſe velocities, and the times of motion jointly; and the ſpaces deſcribed by the accelerating forces acting conſtantly for equal reſpective times, are half the former ſpaces by prop. 16. This will appear perhaps more intelligible from the annexed figure; in which the motion of a body, by an accelerated force, is repreſented by a triangle; for ſuppoſing the body to begin its motion from the point A, and to be uniformly accelerated until it arrived at the point C, it is plain that the velocity acquired would then be properly repreſented by the triangle ABC; but if the acceleration was then to ceaſe, the velocity, and conſequently the ſpace paſſed over, would be repreſented by the parallelogram BCFE, double the triangle ABC. But let us ſuppoſe the acceleration ſtill to go on, as is repreſented in the triangle BDF; it is plain that the ſpace paſſed over in every ſmall moment of time will be compoſed of a parallelogram formed by the velocity laſt acquired, and a triangle formed by the acceleration during that moment, which is entirely in terms of the propoſition, that the ſpaces are in a compound ratio of the velocities laſt acquired, and the times of motion.



18. Conſtant forces which accelerate bodies, cauſe them to deſcribe, from reſt, ſpaces which are as the forces and ſquares of the times wherein they act jointly. For the ſpaces deſcribed are as the velocities laſt acquired, and the times of motion. This will be evident, from an inſpection of the former figure; for in the triangle BDF, let B 1 repreſent the time in which a body acquires a certain velocity; then when it has attained the length of 2, the ſpace paſſed over will be repreſented by a ſmall ſquare, being that of the firſt moment, and of a triangle repreſenting the additional force the ſecond moment.

19. The conſtant forces which accelerate bodies from a ſtate of reſt, are in a direct duplicate ratio of the velocities generated, and in an inverſe ratio of the ſpaces deſcribed. Hence the following corollary is deduced, viz. that the laſt acquired velocities are in a ſubduplicate ratio of the accelerating forces, and a ſubduplicate ratio of the ſpaces deſcribed jointly.

20. If bodies unequal in quantity of matter be impelled from reſt through equal ſpaces, by the action of moving forces which are conſtant, theſe forces are in a duplicate ratio of the laſt acquired velocities, and the ratio of the quantity of matter jointly.

In his obſervations on this propoſition, our author takes occaſion to conſider the theory of thoſe who inſiſt, contrary to the opinion of Sir Iſaac Newton, that the abſolute force of bodies is compounded of the quantity of matter and *ſquare* of the velocity, inſtead of the velocity itſelf. "In the experiments (ſays he) which have been made on the force of bodies, the loſs of motion from reſiſtance has been more attended to than the communication of it by acceleration; and the reaſon probably aroſe from a want of adequate methods of ſubjecting accelerating forces, velocities acquired, and quantities of matter moved, to experimental trials; whereas the impact of bodies on ſubſtances which they penetrate, by affording convenient opportunity for obſerving the depths to which bodies ſink before all motion is deſtroyed, regard being had to the velocities of impact, and the weight and form of the impinging body, has ſeemed a more eligible method, however imperfect, of inveſtigating the principles of motion.—When a body deſcends for three ſeconds by the force of gravity, it acquires, by a force of acceleration, a velocity of $96\frac{1}{4}$ feet in a ſecond: alſo, if a body be projected perpendicularly upward, with a velocity of $96\frac{1}{4}$ feet in a ſecond, the whole velocity will be deſtroyed in three ſeconds; and in like manner, every other property demonſtrated concerning accelerated motions is found to belong to retarded ones, provided we attend to the following circumſtances: If in any propoſition relating to accelerated motion, the force is conſtant, it follows, that when this is applied to retarded motion, the retardation muſt alſo be conſtant. Moreover, ſince in accelerated motions the ſpaces are eſtimated from quieſcence, ſo in retarded motions the bodies are ſuppoſed to move to quieſcence; that is, till all motion is deſtroyed by retardation: in whatever concerns motions of this kind, therefore, we muſt conſider the retarding force to be directly as the force of reſiſtance, and inverſely as the quantity of matter.

"In order to illuſtrate this ſubject, it is to be obſerved, that if a body projected with different initial velocities be retarded by any conſtant given force, the whole ſpaces which the body deſcribes are in a duplicate ratio of the initial velocities, which follows from what has been already demonſtrated; and converſely, ſince when bodies are impelled by an accelerating force through various ſpaces, if theſe ſpaces are always as the ſquares of the laſt acquired velocities, it follows that the force of acceleration is conſtant: ſo when a given body is projected with different velocities, and is retarded by a given force, if the whole ſpaces deſcribed be always in a duplicate ratio of the initial velocities, it is concluded that the force of retardation is

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is conſtant. It is from this argument inferred, that the force whereby blocks of wood, banks of earth, &c. reſiſt the penetration of bodies impinging on them, is conſtant; for it is obſerved, that the depths to which military projectiles of a given magnitude and weight, ſtriking againſt a body of this kind, enter its ſubſtance, are in a duplicate ratio of the initial velocities, which has been ſufficiently proved by Mr Robins, who firſt aſcertained the velocities of military projectiles, and applied his method, among other uſeful purpoſes, to the diſcovery of the retardation which bodies ſuffer by paſſing through reſiſting ſubſtances.

“ The forces of reſiſtance, which are oppoſed to the motion of bodies impinging on ſubſtances which they penetrate, being granted conſtant, the propoſitions concerning acceleration already demonſtrated may be applied to explain the motion of bodies, which having been projected with given initial velocities, are interrupted by ſuch obſtacles as blocks of wood, banks of earth, or others of a ſimilar kind—For example, it has been demonſtrated, that bodies moving from reſt by the acceleration of conſtant forces deſcribe ſpaces which are as the accelerating forces and ſquares of the times jointly. By applying this propoſition to retarded motions, we ſhall have the whole ſpaces or depths to which bodies impinging on the ſubſtances penetrate, as the forces of retardation and ſquares of the times wherein the bodies move, jointly. Moreover, it has been demonſtrated, that if different quantities of matter be impelled from reſt through equal ſpaces, the moving forces will be in a ratio compounded of the duplicate ratio of the velocities laſt acquired, and the ratio of the quantities of matter moved. It is from hence inferred, that in retarded motions alſo, if different quantities of matter be projected againſt any of the ſubſtances above deſcribed, with different initial velocities, and the whole depths to which the bodies penetrate are equal, the forces whereby the bodies reſiſt the progreſs of the impinging bodies will be in a duplicate ratio of the initial velocities of impact and the quantities of matter jointly.

By this propoſition we may examine ſome of the experiments concerning the force of moving bodies, and the concluſions deduced from them by Bernouilli, Leibnitz, Poleni, &c. againſt the meaſure of force delivered by Sir Iſaac Newton, which he deſcribed in the following definitions:

“ The quantity of motion is meaſured by the quantity of matter in a moving body and its velocity jointly.

“ The moving forces whereby bodies tend towards centres of attraction are as the quantities of motion generated in a given time.

“ It follows, then, from theſe definitions; that the moving forces, acting for a given time, will be proportional to the quantities of matter moved, and velocities generated jointly: ſo that if the ratio of the moving forces be known, and we can find by experiment what velocities are generated in given bodies by the action of them for the ſame time; the quantities of motion generated in the bodies may be eſtimated according to Sir Iſacc Newton's definition. Moreover, ſince it is allowed that the effects of a reſiſting force to deſtroy are the ſame as thoſe of an equal force to generate motion in a given time; it follows, that if the ratio of two reſiſting forces be known, the quantities of matter in bodies which impinge on ſubſtances, and penetrate them, and the velocities deſtroyed in a given time, will give the ratio of the quantities of motion deſtroyed, according to Sir Iſaac Newton's definition.

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“ In many of the experiments alluded to, which have been greatly varied and multiplied, the reſiſting forces were made equal, by cauſing ſpheres equal in magnitude to impinge on a given ſubſtance which they penetrated; and the ſpheres being of given denſities, it was obſerved in experiments, that whenever the denſity or weights of theſe equal ſpheres were in an inverſe duplicate ratio of their velocities, the depths to which they penetrated would be equal. The concluſions were theſe: the quantities of matter diſplaced by the moving bodies were equal, the depths to which the equal ſpheres penetrated were the ſame. Moreover, the whole motions which had been communicated to the bodies were deſtroyed; that is, the whole motion of the impinging bodies muſt have been as the ſquares of the velocities into the quantities of matter, But it plainly appears, that this concluſion is not applicable to the Newtonian definition, according to which the moving force generates motion in bodies: and it follows by what has preceded, than the reſiſting force by which the motion of bodies is deſtroyed, is proportional to the quantities of motion generated or deſtroyed in a given time reſpectively: and conſequently to eſtimate the quantity of motion deſtroyed, the time wherein reſiſting forces act ſhould be equal. If, therefore, the times wherein the bodies in the experiment deſcribe the equal ſpaces can be proved different, this will plainly ſhow that the quantities of motion deſtroyed cannot be inferred from the experiment the different times of the bodies deſcribing the depths to which they ſink not being taken into the account this will be eaſily proved, ſince from propoſition 17. it appears, that the ſpaces deſcribed are univerſally as the velocities and ſpaces laſt deſcribed jointly; and from what has been ſaid, the converſe of this propoſition when applied to retarded motions muſt alſo be true. The ſpaces therefore being given as in the experiment, the times will be inverſely as in the initial velocities; which velocities being unequal from the experiment it follows that the times are unequal. This being the caſe, it is manifeſt that no concluſion can be drawn from theſe experiments concerning the quantity of motion deſtroyed, tending to prove any inconſiſtency between the Newtonian eſtimation of force and matter of fact.

“ It is next to be ſhown, that the experiments are ſtrictly conſiſtent with the Newtonian meaſure, and with the theory in general.—It has already been proved, that in accelerated motions the ſpaces deſcribed are in a duplicate ratio of the velocities laſt acquired, and the quantities of matter moved, and an inverſe ratio of the moving forces. This propoſition being applied to retarded motions, it will follow, that the whole ſpaces or depths to which the impinging bodies ſink, are in a duplicate ratio of the quantities of matter, and an inverſe ratio of the reſiſting forces; whence alſo the depths to which the bodies penetrate muſt be equal when ſpheres of equal diameters are projected againſt a given ſubſtance, the weights being in an inverſe duplicate

plicate ratio of the initial velocities, which we find entirely correſpondent to experiment. It ſeems indeed rational to ſuppoſe, independent of all theory, that, in eſtimating the quantities of motion generated or deſtroyed by given moving or reſiſting forces, regard muſt be had to the times wherein the forces act; becauſe moving forces, or thoſe of reſiſtance, may be equal, and may generate or deſtroy quantities of motion varying in any aſſignable degree. For it is manifeſt, that a ſmall reſiſtance, oppoſed to a moving body for a longer time, may deſtroy more motion than a greater force acting for a ſhorter time; which ſufficiently ſhows, that the times wherein the moving and reſiſting forces act, muſt either be equal, or muſt be taken into the account in eſtimating the quantities of motion generated or deſtroyed.

21. The moving forces which communicate, and the forces of reſiſtance which deſtroy, the motion of bodies in the ſame time, will be in a compound ratio of the quantities of matter in the moving bodies and velocities generated or deſtroyed.---This and the preceding propoſitions have been fully illuſtrated and confirmed by experiments. From them we deduce the following facts: 1. When muſket-balls, equal in weight and magnitude, impinge on a block of wood with different velocities, the reſiſting force being conſtant, we ſhall have the whole ſpaces through which the balls move in the wood as the ſquares of the velocities. 2. If balls of equal diameters, but different weights, impinge againſt a block with the ſame velocity, we have the depths to which they penetrate the block as the weights. 3. If balls of the ſame kind of ſubſtance, that is, of the ſame denſity, but of different diameters, impinge againſt a given block of wood or the ſame bank of earth with equal velocities, the depths to which they penetrate will be directly as the diameters of the balls.

When the force of reſiſtance is not uniform, the ſame principle obtains in degree, though the laws are then various; for greater bodies always ſuffer leſs by retardation than ſmaller ones of the ſame denſity, moving through the ſame reſiſting medium, and projected with a given initial velocity: becauſe, though the force of reſiſtance increaſes with the increaſe of the body's magnitude, yet the weight in moſt bodies increaſes in a greater proportion. Thus, in cannon-balls, and other ſolid bodies, though the reſiſtance of the air increaſes as the ſquare of the ball's diameter, yet the weight increaſes as the cube. Thus, if a ball two inches in diameter is projected from the mouth of a piece, it is reſiſted by the atmoſphere four times leſs than one four inches in diameter; but the weight of the latter, being *eight* times greater, makes the reſiſtance leſs upon the whole in the large ball than in the ſmall one. It is otherwiſe when the weight does not increaſe in this manner; for then the ſmaller the body is, the leſs reſiſtance it meets with, and the faſter it goes. This is manifeſt from aeroſtatical experiments; for ſmall air-balloons always outſtrip the larger ones: and the ſame thing is obſervable in boats; for the ſmaller ones, if they have the ſame advantages in proportion to their bulk, will always ſail faſter than the larger ones.

22. If bodies, projected with the ſame velocity, be retarded by different conſtant forces, theſe forces will be in an inverſe ratio of the whole ſpaces deſcribed by the projected bodies, until all motion is deſtroyed.---For example, let a body be projected on an inclined plane, in a direction contrary to that in which gravity acts in the plane, and with a velocity of 144.467 inches in a ſecond. Suppoſe the body then projected, aſcending along the plane, to deſcribe 216 inches before its motion is deſtroyed: let it be required to aſcertain the retarding force which oppoſes its aſcent, that is, the proportion of it to the force of gravity. If the body were projected perpendicularly upward, with the given velocity of 144.467 inches in a ſecond, it would riſe only to 27 inches, as follows in Prop. 19. And ſince it aſcends along the plane 216 inches, the retarding force on the plane will be to that of gravity as 27 to 216, or as 1 to 8; which is alſo the proportion of the height of the plane to the length of it.

From this propoſition, having given the depth to which a body impinging againſt another penetrates it, the proportion of the retarding force of gravity may be determined. For example, Mr Robins found that a leaden ball of $\frac{3}{4}$ of an inch, or $\frac{1}{16}$ of a foot in diameter, impinging on a block of elm with a velocity of 1700 feet in a ſecond, penetrated it to the depth of five inches, or $\frac{5}{12}$ of a foot; wherefore, ſince a body projected upwards with a velocity of 1700 feet in a ſecond, would riſe, if the atmoſphere made no reſiſtance, to the height of 44922 feet, we have the force by which elm retards the ball to the force of gravity as 44922 to $\frac{5}{12}$; or as 107.813 to 1.

On this theory it may further be obſerved, that the reſiſtances oppoſed to ſpherical bodies, which impinge on a block of wood, a bank of earth, &c. depend not only on the tenacity or denſity of the parts, of which the penetrated ſubſtances are compoſed, but upon the diameters of the impinging ſpheres: ſo that, although the reſiſting and retarding forces be determined in any ſubſtance for a ſingle caſe; yet when the diameters and weights of the impinging bodies vary, the forces of reſiſtance and retardation oppoſed to the impact on the ſame ſubſtance will be different. By the preceding propoſition, however, we may be enabled, from a ſingle experiment made on the retardation of any ſubſtance oppoſed to a ſphere, the weight and diameter of which are known, to infer the retardation in any other caſe, however the weights and diameters may vary.

23. If ſpheres of different diameters and different ſpecific gravities impinge perpendicularly on fixed obſtacles, the reſiſting forces of which are conſtant, but of different quantities, the forces which retard the progreſs of the impinging ſpheres will be in a direct ratio of the abſolute forces of reſiſtance, and the joint inverſe ratio of the diameters and ſpecific gravities of the ſpheres. No abſolute concluſion can be drawn from this propoſition concerning any matter of fact, unleſs an experiment be firſt made on the retarding and reſiſting force of ſome ſubſtance which is to be conſidered as a ſtandard.

24. The whole ſpaces or depths to which ſpheres, impinging on different reſiſting ſubſtances, penetrate, are in the ratio compounded of the duplicate ratio of the velocities of impact, the joint ratios of the diameters and ſpecific gravities of the ſpheres, and an inverſe ratio of the abſolute forces whereby the ſubſtances reſiſt the progreſs of the ſpheres.

Mr Atwood concludes this ſection with ſome problems relative chiefly to military projectiles; and in his next ſection (the 4th) conſiders the rectilinear motion of bodies acted upon by fores which vary in ſome ratio of the diſtances from a fixed point. This ſection chiefly relates to the powers of gravity and projection, by which the celeſtial bodies are actuated, and which conſequently chiefly regards aſtronomy and the motion of pendulums; though there are likewiſe ſome curious particulars relating to the action of compreſſed air, the vibration of muſical ſtrings, and the undulation of fluids. The fifth ſection conſiders the motion of bodies immerſed in fluids; but the ſixth treats of a ſubject which properly belongs to mechanics, viz. the communication of motion to bodies revolving round an axis.

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Of rotatory motion.

In treating this ſubject Mr Atwood obſerves, that in the former part of his work he had ſuppoſed the accelerating, as well as reſiſting, forces, to act upon the body in a ſtraight line paſſing through the centre of gravity of the moving; in which caſe every particle of the body muſt partake of the ſame degree of velocity, being equal to that with which the common centre of gravity moves. "But (ſays he) it frequently happens, that a body, or ſyſtem of bodies, is ſo conſtituted, that when any force is impreſſed upon it, no motion can be produced except round a fixed axis; ſo that the velocity of the particles which compoſe the ſyſtem will be greater or leſs according as theſe particles are farther from the common axis or nearer it. Theſe circumſtances ſhould be attended to in order to aſcertain the motion of revolving bodies; the preceding principles of acceleration being not wholly of themſelves ſufficient for that purpoſe.

"In this inveſtigation two things muſt be attended to. 1. The moving force by which the revolving motion is generated; and, 2. The inertia of the parts of which the ſyſtem is compoſed. The moving force exerted on any given particle of the ſyſtem, as well as its inertia, depends on its diſtance from the axis of motion, every thing elſe being the ſame; and if both theſe be aſcertained, the abſolute acceleration of the particle will be determined, and conſequently the abſolute velocity generated in a certain time. The methods therefore of determining theſe forces in any given circumſtance ſhould next be deſcribed.

"Let AFGH (fig. 112.) repreſent the circumference of a wheel which turns in its own plane round an horizontal axis, paſſing through its centre; and let a weight P, fixed at the extremity of a line AP, communicate motion to the wheel. Moreover, let the whole weight of the wheel be Q; and ſuppoſe this weight to be collected uniformly into the circumference AFGH; then, during the deſcent of the weight P, each point of the circumference muſt move with a velocity equal to that with which P deſcends; and conſequently, ſince the moving force is the weight P, and the maſs moved P+Q, the force which accelerates P in its deſcent will, by Prop. 14. be that part of the accelerating force of gravity which is expreſſed by the fraction $\frac{P}{P+Q}$. The velocity, therefore, which is generated in P in any given time, is found from the rules before demonſtrated. Thus, ſuppoſing Q to be equal to P, then will $\frac{P}{P+Q}=\frac{1}{2}$; and the weight P will be accelerated by a power which is to that of gravity as 1 to 2, and ſince gravity generates in bodies which deſcend for one ſecond of time near the earth's ſurface a velocity of $32\frac{1}{6}$ feet in a ſecond; it follows, that the weight P will in the ſame time have acquired a velocity of $16\frac{1}{12}$ feet in a ſecond only.

"The parts of the weight Q which are uniformly diſpoſed over the circumference AFGH, balance each other round the common centre of gravity S; their weight therefore is of no effect in accelerating or retarding the deſcent of P: and this will be the caſe whenever the axis of motion paſſes through the common centre of gravity. But in order to render the properties of rotatory motions more obvious, it will be convenient to diſpoſe the parts of the revolving ſyſtem ſo that the axis of motion ſhall not neceſſarily paſs through the common centre of gravity: thus, inſtead of having the weight Q uniformly diſpoſed over the circumference AFGH, let it be collected into any point Q. Here it is manifeſt, that if the maſs Q be acted upon by gravity, the force which communicates motion to the ſyſtem round S will be variable, it being the greateſt when SQ is horizontal, and gradually diminiſhing till Q has arrived at its loweſt point. But as we would begin with the moſt ſimple caſes, the moving force muſt be conſtant. This will be affected by ſuppoſing the mass which is collected in Q to be deſtitute of weight, and to poſſeſs inertia only. It follows therefore, that during the revolution of Q round S as an axis, the moving force will be conſtantly equal to P, and the maſs moved $=$P+Q. Conſequently the force which accelerates the deſcending weight, or any point in the circumference, will be that part of gravity which is expreſſed by the fraction $\frac{P}{P+Q}$ as before.

"In theſe caſes, the force which communicates motion to the ſyſtem has been ſuppoſed a weight or body acted upon by the earth's gravity, and conſequently conſtitutes a part of the maſs moved, at the ſame time that it acts as a moving force: but motion may be communicated by a force which ſhall add nothing to the inertia of the matter moved: and it will be convenient in many demonſtrations to aſſume the force of this kind; and in this caſe we have not to take the inertia into the account. Thus if any number of bodies without gravity collected into the points F, H, Q, (fig. 112.) are cauſed to revolve round the axis S, by a moving force P, the force which accelerates theſe bodies in their revolution will be $\frac{P}{F+H+Q}$; provided the bodies F, H, Q, be diſpoſed at a diſtance from the axis of motion equal to the radius of the circle AFGH, at the circumference of which the moving force P is applied.

"In the preceding example, F, H, Q, &c. have been ſuppoſed to move with the ſame velocity; but when bodies revolve at unequal diſtances from the axis, their velocities of motion being different, other rules will be neceſſary to determine the force whereby any given point of the ſyſtem is accelerated. In demonſtrating the properties of rotatory motion, the revol-

Fig. 101.

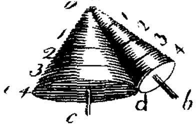


Fig. 102

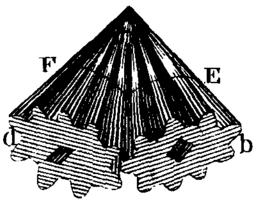


Fig. 103.

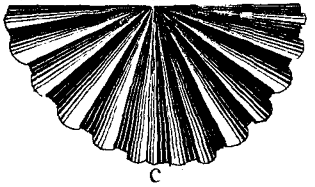


Fig. 104.

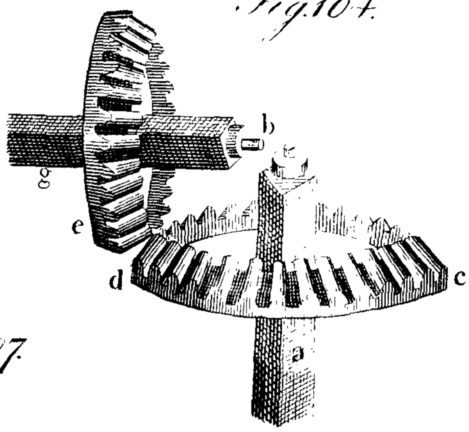


Fig. 105

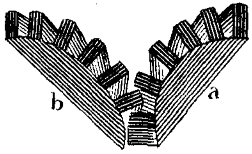


Fig. 106.

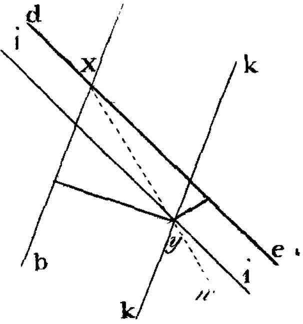


Fig. 107.

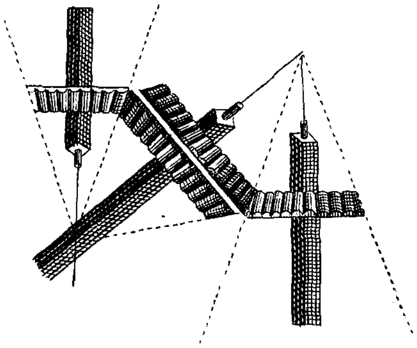


Fig. 109.

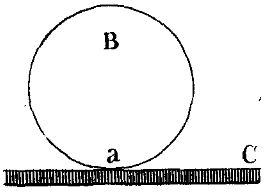


Fig. 108.

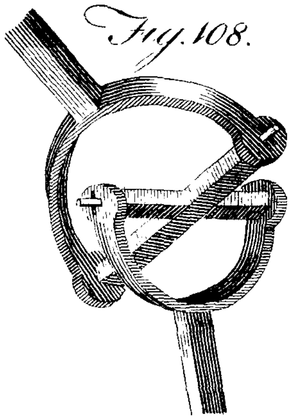


Fig. 110.

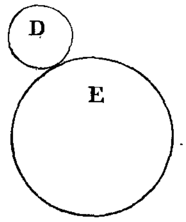


Fig. 112.

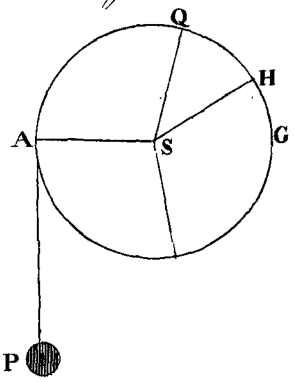


Fig. 113.

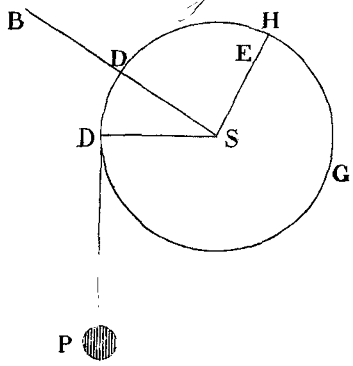


Fig. 111.

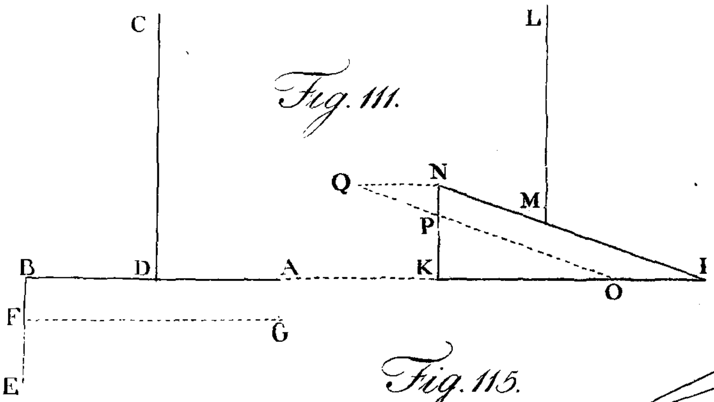


Fig. 114.

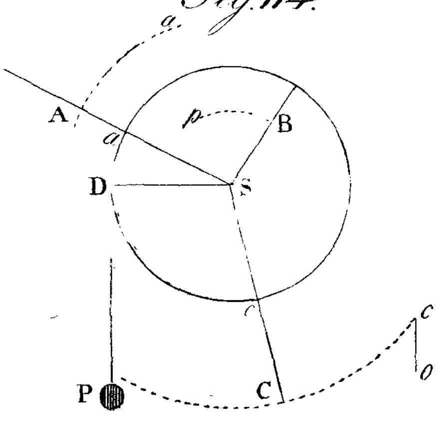
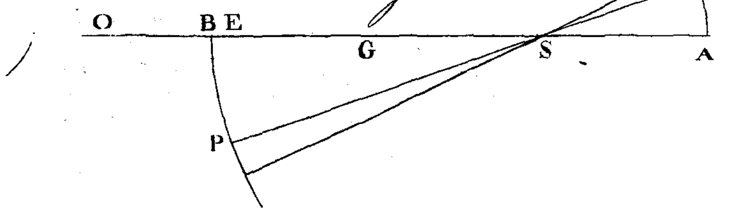


Fig. 115.



ving ſyſtem may be ſuppoſed to conſiſt of one or more of the bodies A, B, C: the magnitude of theſe may be ſuppoſed evaneſcent; becauſe, were the contrary ſuppoſition adopted, the particles in each body would be impelled by different moving forces, and exert different degrees of inertia in oppoſition to the communication of motion. But the force which impels each individual particle, and the effects of its inertia in different circumſtances, muſt be known before the acceleration of the whole ſyſtem can be determined.

"The bodies A, B, and C, which may be termed, according to the ideas juſt deſcribed, material points, are imagined to be connected together by ſome perfectly rigid ſubſtance, ſo as always to poſſeſs the ſame ſituation in reſpect to each other: and conſequently no motion can be produced in any of them, excepting that all revolve at the ſame time round the common axis of motion.

"All the points in this imaginary ſubſtance, by which the parts of the ſyſtem are connected together, partake of the ſame angular motion, deſcribing circles round the common axis S. A force P therefore being applied to any point in the plane of its motion, and in the direction of any line in that plane which paſſes not through the axis, will communicate an equal angular motion to the whole. Thus let B (fig. 113.) repreſent a material point moveable about an axis of motion paſſing through S. With the radius SD deſcribe a circle DGH. Now if B be connected with every point in the area of this circle, which is an inflexible ſubſtance, no force can be applied to move the circle but what muſt communicate the ſame angular motion to B. Let the force be applied at the point D; it is manifeſt, that in order to render its effects conſtant, the inclination of its direction to SD muſt be always the ſame, and in a given plane; and the moſt obvious method of effecting this, either in conſidering the ſubject theoretically, or in the practical illuſtration of it, is by applying a thin and flexible line GHDP round the circumference of the circle DGH, and ſtretching this line by a given moving force P. Here it is plain, that in whatever part the point D is ſituated, the effects of the force P will be the ſame as if it were directly applied to D in the direction of the plane of motion, and perpendicular to SD, and the point B will revolve with the ſame abſolute and angular velocity in both caſes.

"Let now ABC (fig. 114.) be a ſyſtem of bodies of evaneſcent magnitude and without gravity, moveable about an axis of motion which paſſes through S; it muſt be obſerved, that the imaginary ſubſtance by which the parts of the ſyſtem ABC are connected, muſt contribute nothing either by its weight or inertia to accelerate or retard the motion of the material points A, B, C, which are cauſed to revolve by the action of the given and conſtant force P, applied at the diſtance from the axis SD. The abſolute force of P to move D, or any point of the circumference, will be P; but the communication of motion to this point D is reſiſted by the inertia of the bodies A, B, C; which being moved with different velocities, and acted on by different moving forces, their inertia will not be eſtimated by their quantities of matter only, according to the laws obſerved in rectilinear motion: the force which accelerates D, therefore, cannot be obtained by dividing P by A+B+C; but if an equivalent maſs, or a quantity of matter, can be aſſigned, which being collected into any points of the circumference *a*, *b*, *c*, will cauſe an inertia or reſiſtance to the motion of D equal to that exerted by the particles A, B, C, when revolving at their reſpective diſtances, the force which accelerate the circumference or any point in it D will be determined. Thus, let the maſs Q, when collected into *a*, be ſuch as will be equivalent in its inertia to A, when revolving at the diſtance SA; alſo let R be the maſs collected into *b*, which is equivalent to B when revolving at the diſtance SB; and let T, the maſs collected into C, be equivalent to C when revolving at the diſtance SC; then will the maſs moved by the force P be Q+R+T; and the force which accelerates the circumference $=\frac{P}{Q+R+T}$, being equal to that by which the circumference or any point in it is accelerated when the point conſiſts of A and B and C, revolving at the reſpective diſtances from the axis of motion SA, SB, SC."

70 Of revolving bodies.

Our author now proceeds particularly to inveſtigate the motion of revolving bodies in almoſt all poſſible circumſtances, deducing from his propoſitions many concluſions very uſeful in practical mechanics. Many of theſe regard the pendulum, and are therefore taken notice of under that article; others more immediately relate to the parts of mechanics particularly treated of in this article: the principal of which follow.

1. The force which accelerates the centre of gravity of a ſphere, while it rolls down an inclined plane, is to the force by which it would be accelerated were it to ſlide in the ratio of five to ſeven. As our limits will not admit of inſerting at length the demonſtration of this and other propoſitions, we ſhall in this only obſerve, that when a wheel or a ſphere *rolls*, the circumference goes backward, while the centre moves forward; which retrogade motion muſt of neceſſity make the other ſlower than it would otherwiſe be: and this retardation Mr Atwood has determined to be in the proportion abovementioned.

From this propoſition the following corollaries are deduced. 1. The abſolute force whereby motion is generated in the circumference of a ſphere in ſuch a ſituation, is expreſſed by a fraction conſiſting of twice the weight of the ſphere divided by ſeven, and multiplied into another fraction conſiſting of the height of the plane divided by its length; that is, ſuppoſe the weight of the ſphere to be repreſented by *w*, the height of the plane by *h*, and its length by *l*, the force by which the circumference of the ſphere is impelled will be repreſented by $\frac{w}{7}\times\frac{h.}{l}$ 2. In the ſame manner, let a cylinder roll down an inclined plane, keeping the axis always horizontal, and the force which accelerates the axis will be repreſented by the fraction $\frac{2}{3}\times\frac{h}{l}$.

2. Let AB (fig. 115.) repreſent a ſtraight lever moveable round an horizontal axis of motion, which paſſes through S. Let the arms be SB, SA. Suppoſe a weight W to be affixed to the extremity of the

ſhorter arm, and to be raiſed by the weight P applied at the extremity of the longer arm, when the lever is horizontal. Required to determine the time in which W will be raiſed through any given height, the weight and inertia of the lever itſelf not being conſidered.

"Where there is an equilibrium (ſays Mr Atwood) on any mechanic power, the proportion of the weight ſuſtained to the power ſuſtaining it, will, in all caſes, be aſſigned from having given the dimenſions of the mechanic power. An equilibrium having been once formed, the ſmalleſt addition of weight will cauſe the body to which it is applied on either ſide to preponderate. In this caſe a certain degree of motion is generated; and ſince the uſes of the mechanic powers are not only to ſuſtain forces in equilibrio, but to raiſe weights and overcome reſiſtances, it is a problem of principal conſequence to aſſign the abſolute quantity of motion generated by a known moving force in given circumſtances." The general ſolution of the problem is as follows:

"Let AB be the lever, W the weight moved by the power P; each acting in a direction perpendicular to the horizon. Let G be the common centre of gravity of the whole ſyſtem, including the weights P and W with the lever itſelf; and o the centre of oſcillation *, when AB vibrates round the axis S; the force which accelerates B when the lever is horizontal $=\frac{SG\times SB}{SG\times SO}=\frac{SB}{SO}$ (c). If this be put $=F$, the time wherein P deſcends through a perpendicular ſpace x, and conſequently wherein W aſcends through the correſponding ſpace; then $x\times\frac{SA}{SB}=\sqrt{\frac{x}{lF}}$ (D). $\times\sqrt{\frac{1+x^2}{SB^2 2.5}}$, &c.

&c. $=\sqrt{\frac{x}{l}\times\frac{SG}{SB}\times 1+\frac{x^2}{SB^2 2.5}}$, &c.

* See Pendulum.

73 On the wheel-axle. Plate CCXCI.

3. Let ABC (fig. 116.) repreſent a wheel and axle, its weight w, and let the axis be horizontal; having a given weight Q applied to the circumference of the axle, and P applied to the circumference of the wheel in order to raiſe Q. Required to aſſign the ſpace deſcribed by the elevated weight Q in any given time. The ſolution of this problem, without attending to the demonſtration, is this. Having found the accelerating power, which here is $\frac{P\times SD-Q\times SA\times SA}{w\times SR^2\text{ (E.)}+p\times SD^2+Q\times SA^2}$. All this he puts $=F$; and then l being $=193$ inches as before, the ſpace deſcribed by Q in any number of ſeconds will be = the ſquare of that number of ſeconds multiplied into lF. On this propoſition our author makes the following obſervations.

"Whenever motion is communicated to a body, a certain reſiſtance muſt have been overcome by the moving force. This reſiſtance is of various kinds. 1. The inertia of the maſs, moved, whereby it endeavours to perſevere in its ſtate of quieſcence, or of uniform motion in a right line. 2. That of a weight or other abſolute force oppoſed to the action of the moving power. 3. Obſtacles upon which the moving body impinging is retarded in its progreſs: ſuch, for example, is the reſiſtance which ariſes from the particles of a fluid thro' which a body moves. The eſtimation of theſe reſiſtances, and their effects in retarding the motion of bodies acted on by a given force, are deducible from the laws of motion, and conſtitute a part of the ſolution of almoſt all problems relating to the motion of bodies.

"The moving forces alſo are of various kinds, viz. The power of gravity, muſcular power, the impact of bodies, ſolid and fluid, &c. It has been ſhown, that the effects of theſe moving forces which are exerted on bodies in order to create motion, excluſive of the reſiſtance oppoſed to them, depend on the various circumſtances of the time in which they act, and on the ſpaces through which the bodies moved are impelled, &c.

"Theſe conſiderations are urged, to ſhow, that from the great variety of undetermined conditions which may enter into mechanical problems, there muſt of courſe be various methods of producing the ſame mechanical effect: and it is a very material part of the art, conſidered either in a theoretical or practical view, to proportion the means to the end, and to effect this with all advantages which the nature of the caſe is capable of. It is the due obſervation of theſe particulars which contributes to render mechanic inſtruments complete, and the neglect of them defective, in their conſtruction. This proper choice of means to produce mechanical effects, is frequently the reſult of long continued experience independent of all theory; the knowledge of which, however, when applied to practice, would ſave the artiſt much time and trouble, as well as would be productive of other advantages, which experience alone muſt be deſtitute of."

4. ABC (fig. 116.) is a wheel and axis moveable round an horizontal axis, which paſſes through S. Suppoſe a given weight Q, which is applied to the circumference of the axle; let it be required to aſſign the proportion of the radii of the wheel and axle, ſo that the time in which the weight Q aſcends through any given ſpace ſhall be the leaſt poſſible. In this caſe, ſuppoſing the radius of the wheel to be 10 inches, and its weight 20 ounces; let the radius of the axle SA = 1 inch, the weight to be raiſed thro' any given ſpace to be 100 ounces, the moving force by which it is raiſed to be 33 ounces; then the diſtance of the centre of gyration from the axis is $\sqrt{50}$ inches; and the length of the radius ſought is 9.55 inches.—If, inſtead of raiſing the weight perpendicularly, it be required to draw it horizontally, and to aſſign the diſtance SD, at which, if a given force P be applied, the time of deſcribing a given ſpace ſhall be the leaſt, and the moment of q the greateſt poſſible, we have the following concluſion. "Let the quantity of matter to be drawn along the plane be four times greater than that which is contained in the moving

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(c) This he had formerly proved when treating of pendulums.

(D) l is here put for 193 inches, the ſuppoſed velocity of the weight P.

(E) R is the centre of gyration of the wheel.

ving force; the radius of the axle SA being given; in order that it may be impelled with the greateſt velocity poſſible and with the greateſt moment, the radius of the wheel ſhould be double that of the axle when the inertia of the wheel is not conſidered.

5. Let ARCH (fig. 117.) be a ſyſtem of bodies moveable round a vertical axis which paſſes through the common centre of gravity of the ſyſtem. Suppoſe DEG to be a wheel, the axis of which is vertical, and coincident with that of the ſyſtem; let motion be communicated by means of a line going round this wheel, the ſtring DP being ſtretched by a given weight P; let it be required to aſſign the radius of the wheel EGD, ſo that the angular velocity communicated to the ſyſtem may be the greateſt poſſible. Here, ſuppoſing the moving force to be one-fourth of the weight of the ſyſtem, it ſhould be applied at a diſtance from the axis equal to twice the diſtance of the centre of gyration, in order to produce the greateſt poſſible angular velocity in a given time.

"In order (ſays Mr Atwood) to increaſe the action of a moving force againſt a weight to be raiſed, or reſiſtance to be overcome, a combination of two or more mechanic powers is frequently made uſe of. Let *p* (fig. 118.) be a power applied by means of a line to the vertical wheel C: ſuppoſe the circumference of the axle K to be in contact with the circumference of any other vertical wheel B; ſo that the circumference of the wheel B may always move equally faſt with that of the axle which belongs to C; let alſo the axle of B communicate motion to a vertical wheel A, to the axle of which a weight *q* is ſuſpended, ſo as to act in oppoſition to *p*; moreover, let the ratio of *lmn* to 1 be the ſum of the ratios of the radius of each wheel to that of its axle: then, if $plmn = q$, the two weights *p* and *q* will ſuſtain each other in equilibrio; but if *plmn* be at all greater than *q*, the equilibrium will be deſtroyed;" and our author gives a method of calculating the quantity of motion communicated in certain circumſtances.

Our author next goes through a ſet of ſimilar propoſitions relating to the pulley and wedge; after which he treats of the accumulation of power in ponderous cylinders, and the uſe of balaſt-wheels in machines, of which mention has already been made; and having diſcuſſed theſe ſubjects, he next comes to treat of the action of a ſtream of water upon a wheel revolving round an horizontal axis.

6. Let ABC (fig. 119.) repreſent a water-wheel which revolves round an horizontal fixed axis, paſſing through its centre S. Suppoſe DEF to be the axle of this wheel, and that a weight W is affixed to a line DW, ſo wound round the axle, that while the wheel is driven round its own plane by the force of the water impinging at I, the weight W may be raiſed in a vertical line: having given the area of the boards II, againſt which the ſtream impinges perpendicularly, and the altitude from which the water deſcends, it is required to aſſign the greateſt velocity with which the wheel can revolve.

"When a ſtream of any fluid (ſays he) impinges perpendicularly againſt a plain and quieſcent ſurface, the exact quantity of the moving force is equal to the weight of a column of the fluid, the baſe of which is the area upon which the fluid impinges, and the altitude that from which a body muſt deſcend freely from reſt by gravity, in order to acquire that velocity. This will be the moving force which impels the body when quieſcent or juſt beginning to move: but after it has acquired ſome motion, the impulſive force of the body will be diminiſhed; being the ſame as if the body were quieſcent, and the water impinged upon it with the difference of the former velocities. Wherefore the altitude of the column of the fluid, which is equal to its impelling force, will be always as the difference between the velocity of the impact and that of the body itſelf; and ſince the altitudes from which bodies fall from reſt are in a duplicate ratio of the velocities acquired, it follows, that the force of the impact will be in a duplicate ratio of the difference between the velocity of the wheel and that of the impact." The following is the concluſion drawn by Mr Atwood concerning the velocity: Putting A for the weight of the column of water when the wheel is quieſcent; V the velocity with which it impinges on boards II, &c. and *y* the velocity of the circumference ſought; W the weight of the wheel; then $y = V - V \times \sqrt{\frac{W}{A} \times \frac{SD}{SI}}$.

71 Atwood's obſervations on water-mills.

7. Every other thing remaining the ſame, let the weight W be varied; and let it be required to aſſign the weight W, ſo that when the wheel has acquired its uniform velocity, the moment of W may be the greateſt poſſible. Here the weight $= \frac{4A \times SI}{9SD}$.

8. Having given a weight W to be raiſed by the action of the ſtream of water, the force of which is $= A$ againſt a quieſcent ſurface; let it be required to aſſign what muſt be the proportion between the radius of the wheel and that of the axle; ſo that the uniform velocity of the aſcending weight may be the greateſt poſſible. Here the length of the radius $= \frac{9W \times SD}{4A}$. Hence he concludes, that if the velocity with which the water impinges againſt the boards be doubled, the greateſt moment communicated to a weight aſcending uniformly, will be increaſed in the proportion of 8 to 1.

"The force (ſays Mr Atwood) which communicates motion to water-wheels, and the reſiſtances which are occaſioned by friction, tenacity, and various other cauſes, render the application of the theory of mechanics to practice, in theſe caſes, extremely difficult. It is probably from this reaſon, that the conſtruction of machines moved by the force of water, &c. has been almoſt wholly practical, the beſt improvements having been deduced from continued obſervation of the reſults produced in given circumſtances; whereby the gradual correction of error, and varied experience of what is moſt effectual, have ſupplied the place of a more perfect inveſtigation from the laws of motion.

"This ſeems to be the beſt method, as far as regards the practical conſtruction of theſe machines, the nature of the caſe will admit of; for although there may be two ways leading ultimately to the ſame truths, *i. e.* a direct inveſtigation from the laws of motion and long continued obſervation, independent of theory, the latter is frequently the moſt eaſy and intelligible, although leſs direct and leſs ſcientific; the former being inacceſſible to thoſe who poſſeſs the elementary

mentary parts of mechanics only. It is in vain to attempt the application of the theory of mechanics, to the motion of bodies, except every cauſe which can ſenſibly influence the moving power and the reſiſtance to motion be taken into account: if any of theſe be omitted, error and inconſiſtency in the concluſions deduced muſt be the conſequence. It was at one time ſuppoſed, from this inadequate application of the theory, that the ſame laws of motion would not extend to all branches of mechanics, but that different principles were to be accommodated to different kinds of motion. If this were truly the caſe, the ſcience of mechanics would fall ſhort of that ſuperior excellence and extent which it is generally allowed to poſſeſs. For it is probable, that there is no kind of motion but what may be referred to three eaſy and obvious propoſitions, the truth of which it is impoſſible to doubt: and if we are not enabled to inveſtigate the effects from the data in all caſes, the deficiency muſt not be imputed to the ſcience of mechanics, but to the want of methods of applying mathematics to it.

“ This may be illuſtrated by an example, in order to ſhow that the motion communicated to water-wheels, however complicated the data may be, is equally referable to the laws of motion, with the effects of the moſt uncompounded force. If a ſtream of water falls perpendicularly on a plain ſurface, the moving force ariſing from the impact only is equal to the weight of a column of water, the baſe of which is the ſurface upon which the water impinges, and altitude that through which a body muſt fall to acquire the velocity of impact. If the inclination of the ſtream to the ſurface ſhould be changed, the force exerted in a direction perpendicular to the plane will be diminiſhed in a duplicate ratio of the radius to the ſine of inclination; the ſurface on which the water impinges remaining. Now, when the water falls on the boards of a water-wheel, the direction of the ſtream makes different angles with the planes of thoſe boards; for ſince the particles of water deſcend in curve lines, they will ſtrike any plain ſurface in the direction of a tangent to the curve on the point of impact. Moreover, the water will ſtrike the higher boards TT with leſs velocity, and in a direction more inclined to their planes, than the lower ones II; it is alſo to be conſidered, that the ſtream will impinge on the boards at different diſtances from the axis of motion: all which circumſtances muſt be taken into account, to find the force which tends to communicate motion to the wheel when quieſcent; and when motion has been communicated, the force of the ſtream to turn the wheel will be determined in the manner already mentioned. But this is not the only conſideration which affects the moving force: The force hitherto conſidered has been ſuppoſed to ptoceed from the impact of the particles only; in which caſe, each particle after it has ſtruck the board is imagined to be of no other effect in communicating motion: but this is not wholly the caſe; for after the particle has impinged on the board, it will continue ſome time to operate by its weight; and this time will be longer or ſhorter according to the different conſtructions of the wheel. In the overſhot wheel, the continuance of the preſſure, ariſing from the weight of the water, will be longer than in the underſhot, the force which ariſes from the impact of the water being nearly the ſame in each caſe. The whole moving force, therefore, will conſiſt of the impact determinable as above, and of the weight of the water deſcending along with the circumference, and communicating additional motion to it: this entire moving force being determined either by theory or experience, may be denoted by A. After the moving force which impels the circumference has been determined, the reſiſtance to this force muſt be found; for on the proportion between the moving force and the reſiſtance, the acceleration of the machine will depend. This reſiſtance is of various kinds: 1. That of inertia. 2. If the machine is of that kind which raiſes weights, ſuch for inſtance as water; the weight raiſed, allowing for its mechanical effect on the point of which we deſire to know the acceleration, muſt be ſubducted from the moving force before found; and this will be a conſtant quantity. There are other reſiſtances alſo homogeneal to weight, viz thoſe of friction and tenacity, &c. which are variable in ſome ratio of the machine's velocity: in order to proceed with the inveſtigation, the exact quantity of weight which the friction is equal to, when the wheel moves with a given velocity, muſt be conſidered, as well as the variation of the reſiſtances in reſpect to the velocities; which circumſtances muſt be determined by experiment. If the force equivalent to the friction, &c. be ſubducted from the moving force, the remainder will give the moving power, by which the circumference is impelled upon the whole: this being divided by the inertia of the maſs moved, will give the force which accelerates the circumference.

Fig. 119.

The following apparatus has been invented by Mr Atwood, for illuſtrating his doctrines concerning accelerated motion, and has been found to anſwer the purpoſe more completely than any other we have heard of: diſcovering at once the quantity of matter moved, the force which moves it, the ſpace deſcribed from reſt, the time of deſcription and the velocity acquired.

1. *Of the maſs moved.*—In order to obſerve the effects of the moving force, which is the object of any experiment, the interference of all other forces ſhould be prevented: the quantity of matter moved, therefore, conſidering it before any impelling force has been applied, ſhould be without weight; for although it be impoſſible to abſtract the natural gravity or weight from any ſubſtance whatever, yet the weight may be ſo counteracted as to be of no ſenſible effect in experiments. Thus in the inſtrument conſtructed to illuſtrate this ſubject experimentally, A, B, fig. 120. repreſent two equal weights affixed to the extremities of a very fine and flexible ſilk line; this line is ſtretched over a wheel or fixed pulley *abcd*, moveable round an horizontal axis: the two weights A, B, being preciſely equal and acting againſt each other, remain in equilibrio; and when the leaſt weight is ſuperadded to either (ſetting aſide the effects of friction), it will preponderate. When AB are ſet in motion by the action of any weight *m*, the ſum $A+B+m$ would conſtitute the whole maſs moved, but for the inertia of the materials which muſt neceſſarily be uſed in the communication of motion: theſe materials conſiſt of,

Motion of Bodies.

1. The wheel *a b c d*, over which the line ſuſtaining A and B paſſes. 2. The four friction wheels on which the axle of the wheel *a b c d* reſts: the uſe of theſe wheels is to prevent the loſs of motion, which would be occaſioned by the friction of the axle if it revolved on an immoveable ſurface. 3. The line by which the bodies A and B are connected, ſo as when ſet in motion to move with equal velocities. The weight and inertia of the line are too ſmall to have ſenſible effect on the experiments; but the inertia of the other materials juſt mentioned conſtitute a conſiderable proportion of the maſs moved, and muſt be taken into account. Since when A and B are put in motion, they muſt neceſſarily move with a velocity equal to that of the circumference of the wheel *a b c d* to which the line is applied; it follows, that if the whole maſs of the wheels were accumulated in this circumference, its inertia would be truly eſtimated by the quantity of matter moved; but ſince the parts of the wheels move with different velocities, their effects in reſiſting the communication of motion to A and B by their inertia will be different; thoſe parts which are furtheſt from the axis reſiſting more than thoſe which revolve nearer in a duplicate proportion of thoſe diſtances. If the figures of the wheels were regular, from knowing their weights and figures, the diſtances of their centres of gyration from their axes of motion would become known, and conſequently an equivalent weight, which being accumulated uniformly in the circumference *abcd*, would exert an inertia equal to that of the wheels in their conſtructed form. But as the figures are wholly irregular, recourſe muſt be had to experiment, to aſſign that equivalent quantity of matter, which being accumulated uniformly in the circumference of the wheel *abcd*, would reſiſt the communication of motion to A in the ſame manner as the wheels.

In order to aſcertain the inertia of the wheel *abcd*, with that of the friction wheels, the weights AB being removed, the following experiment was made.

A weight of 30 grains was affixed to a ſilk line (the weight of which was not ſo much as $\frac{1}{4}$th of a grain, and conſequently too inconſiderable to have ſenſible effect in the experiment); this line being wove round the wheel *a b c d*, the weight 30 grains by deſcending from reſt communicated motion to the wheel, and by many trials was obſerved to deſcribe a ſpace of about $38\frac{1}{2}$ inches in 3 ſeconds. From theſe data the equivalent maſs or inertia of the wheels will be known from this rule:

Let a weight A (fig. 121.) be applied to communicate motion to a ſyſtem of bodies by means of a very ſlender and flexible line going round the wheel SLDIM, through the centre of which the axis paſſes (G being the common centre of gravity, R the centre of gravity of the matter contained in this line, and O the centre of oſcillation). Let this weight deſcend from reſt through any convenient ſpace s inches, and let the obſerved time of its deſcent be t ſeconds; then if l be the ſpace through which bodies deſcend freely by gravity in one ſecond, the equivalent weight ſought $=$ $\frac{W\times SR\times SO}{SD^2}=\frac{P\times t^2 l}{s}-P.$

Here we have $p=30$ grains, $t=3$ ſeconds, $l=193$ inches, $s=38.5$ inches; and $\frac{P\times t^2 l}{s}-P=\frac{30\times 9\times 193}{385}-30=1323$ grains, or $2\frac{1}{4}$ ounces.

Motion of Bodies.

This is the inertia equivalent to that of the wheel *a b c d*, and the friction wheels together: for the rule extends to the eſtimation of the inertia of the maſs contained in all the wheels.

The reſiſtance to motion therefore ariſing from the wheel's inertia, will be the ſame as if they were abſolutely removed, and a maſs of $2\frac{3}{4}$ ounces were uniformly accumulated in the circumference of the wheel *a b c d*. This being premiſed, let the boxes A and B be replaced, being ſuſpended by the ſilk line over the wheel or pulley *a b c d*, and balancing each other: ſuppoſe that any weight m be added to A ſo that it ſhall deſcend, the exact quantity of matter moved, during the deſcent of the weight A, will be aſcertained, for the whole maſs will be $A+B+m+2\frac{3}{4}$ oz.

In order to avoid troubleſome computations in adjuſting the quantities of matter moved and the moving forces, ſome determinate weight of convenient magnitude may be aſſumed as a ſtandard, to which all the others are referred. This ſtandard weight in the ſubſequent experiments is $\frac{1}{4}$ of an ounce, and is repreſented by the letter m. The inertia of the wheels being therefore $=2\frac{3}{4}$ ounces, will be denoted by $11\,m$. A and B are two boxes conſtructed ſo as to contain different quantities of matter, according as the experiment may require them to be varied: the weight of each box, including the hook to which it is ſuſpended, $=1\frac{1}{2}$ oz. or according to the preceding eſtimation, the weight of each box will be denoted by $6\,m$; theſe boxes contain ſuch weights as are repreſented by fig. 122. each of which weighs an ounce, ſo as to be equivalent to $4\,m$; other weights of $\frac{1}{2}$oz $=2m$, $\frac{1}{4}=m$, and aliquot parts of m, ſuch as $\frac{1}{2}m$, $\frac{1}{4}m$, may be alſo included in the boxes, according to the concluſions of the different experiments hereafter deſcribed.

If $4\frac{3}{4}$ oz. or $19\,m$, be included in either box, this with the weight of the box itſelf will be $25m$; ſo that when the weights A and B,, each being $25m$, are balanced in the manner above repreſented, their whole maſs will be $50\,m$, which being added to the inertia of the wheels $11\,m$, the ſum will be $61\,m$. Moreover, three circular weights, ſuch as that which is repreſented at fig. 123. are conſtructed; each of which $=\frac{1}{4}$ oz. or m: if one of theſe be added to A and one to B, the whole maſs will now become $63m$, perfectly in equilibrio, and moveable by the leaſt weight added to either (ſetting aſide the effects of friction), in the ſame manner preciſely as if the ſame weight or force were applied to communicate motion to the maſs $63m$, exiſting in free ſpace and without gravity.

2. *The moving Force.* Since the natural weight or gravity of any given ſubſtance is conſtant, and the exact quantity of it eaſily eſtimated, it will be convenient here to apply a weight to the maſs A as a moving force: thus, when the ſyſtem conſiſts of a maſs$=63m$, according to the preceding deſcription, the whole being perfectly balanced, let a weight $\frac{1}{4}$oz. or m, ſuch as is repreſented in fig. 124. be applied on the maſs A; this will communicate motion to the whole ſyſtem: by adding a quantity of matter m, to the former maſs $63m$, the whole quantity of matter moved will now become

become 64 m; and the moving force being $=m$, this will give the force which accelerates the deſcent of A $=\frac{m}{64m}$, or $\frac{1}{64}$ part of the accelerating force by which the bodies deſcend freely towards the earth's ſurface.

By the preceding conſtruction, the moving force may be altered without altering the maſs moved; for ſuppoſe the three weights m, two of which are placed on A, and one on B to be removed, then will A balance B. If the weights 3 m be all placed on A, the moving force will now become 3 m, and the maſs moved 64 m as before, and the force which accelerates the deſcent of $A=\frac{3\,m}{64m}=\frac{3}{64}$ parts of the force by which gravity accelerates bodies in their free deſcent to the ſurface.

Suppoſe it were required to make the moving force 2 m, the maſs moved continuing the ſame. In order to effect this, let the three weights, each of which $=m$, be removed; A and B will balance each other; and the whole maſs will be 61 m: let $\frac{1}{2}\,m$, fig. 124. be added to A, and $\frac{1}{2}\,m$ to B, the equilibrium will ſtill be preſerved, and the maſs moved will be 62 m; now let $2m$ be added to A, the moving force will be $2m$, and the maſs moved $64m$, as before; wherefore the force of acceleration $=\frac{1}{32}$ part of the acceleration of gravity. Theſe alterations in the moving force may be made with great eaſe and convenience in the more obvious and elementary experiments, there being no neceſſity for altering the contents of the boxes A and B: but the proportion and abſolute quantities of the moving force and maſs moved may be of any aſſigned magnitude, according to the conditions of the propoſition to be illuſtrated.

3. *Of the ſpace deſcribed.* The body A, fig. 120. deſcends in a vertical line; and a ſcale about 64 inches in length graduated into inches and tenths of an inch is adjuſted vertical, and ſo placed that the deſcending weight A may fall in the middle of a ſquare ſtage, fixed to receive it at the end of the deſcent: the beginning of the deſcent is eſtimated from o on the ſcale, when the bottom of the box A is on a level with o. The deſcent of A is terminated when the bottom of the box ſtrikes the ſtage, which may be fixed at different diſtances from the point o; ſo that by altering the poſition of the ſtage, the ſpace deſcribed from quieſcence may be of any given magnitude leſs than 64 inches.

4. *The time of motion* is obſerved by the beats of a pendulum, which vibrates ſeconds; and the experiments, intended to illuſtrate the elementary propoſitions, may be eaſily ſo conſtructed that the time of motion ſhall be a whole number of ſeconds: the eſtimation of the time, therefore, admits of conſiderable exactneſs, provided, the obſerver takes care to let the bottom of the box A begin its deſcent preciſely at any beat of the pendulum; then the coincidence of the ſtroke of the box againſt the ſtage, and the beat of the pendulum at the end of the time of motion, will ſhow how nearly the experiment and the theory agree together. There might be various mechanical devices thought of for letting the weight A begin its deſcent at the inſtant of a beat of the pendulum W; let the bottom of the box A, when at o on the ſcale, reſt on a flat rod, held in the hand horizontally, its extremity being coincident with o, by attending to the beats of the pendulum; and with a little practice, the rod which ſupports the box A may be removed at the moment the pendulum beats, ſo that the deſcent of A ſhall commence at the ſame inſtant.

4. *Of the velocity acquired.* It remains only to deſcribe in what manner the velocity acquired by the deſcending weight A, any given point of the ſpace through which it has deſcended, is made evident to the ſenſes. The velocity of A's deſcent being continually accelerated will be the ſame in no two points of the ſpace deſcribed. This is occaſioned by the conſtant action of the moving force; and ſince the velocity of A at any inſtant is meaſured by the ſpace which would be deſcribed by it, moving uniformly for a given time with the velocity it had acquired at that inſtant, this meaſure cannot be experimentally obtained, except by removing the force by which the deſcending body's acceleration was cauſed.

In order to ſhow in what manner this is affected particularly, let us again ſuppoſe the boxes A and B $=25\ m$ each, ſo as together to be $=50\,m$; this with the wheel's inertia 11 m will make 61 m; now let m, fig. 122, be added to A, and an equal weight m to B, theſe bodies will balance each other, and the whole maſs will be 63 m. If a weight m be added to A, motion will be communicated, the moving force being m, and the maſs moved 64 m. In eſtimating the moving force, the circular weight $=m$ was made uſe of as a moving force; but for the preſent purpoſe of ſhowing the velocity acquired, it will be convenient to uſe a flat rod, the weight of which is alſo $=m$. Let the bottom of the box A be placed on a level with o on the ſcale, the whole maſs being as deſcribed above $=63\ m$, perfectly balanced in equilibrio. Now let the rod, the weight of which $=m$, be placed on the upper ſurface of A; this body will deſcend along the ſcale preciſely in the ſame manner as when the moving force was applied in the form of a circular weight. Suppoſe the maſs A, fig. 125, to have deſcended by conſtant acceleration of force of m, for any given time, or through a given ſpace; let a circular frame be ſo affixed to the ſcale, contiguous to which the weight deſcends, that A may paſs centrally through it, and that this circular frame may intercept the rod m by which the body A has been accelerated from quieſcence. After the moving force m has been intercepted at the end of the given ſpace or time, there will be no force operating on any part of the ſyſtem which can accelerate or retard its motion: this being the caſe, the weight A, the inſtant after m has been removed, muſt proceed uniformly with the velocity which it had acquired that inſtant: in the ſubſequent part of its deſcent, the velocity being uniform will be meaſured by ſpace deſcribed in any convenient number of ſeconds.

Other uſes of the inſtrument It is needleſs to deſcribe particularly, but it may not be improper juſt to mention the further uſes of this inſtrument; ſuch as the experimental eſtimation of the velocities communicated by the impact of bodies elaſtic and nonelaſtic; the quantity of reſiſtance oppoſed by fluids, as well as for various other purpoſes. Theſe uſes we ſhall not inſiſt on; but the properties of retarded motion being a part of the preſent ſubject, it may be neceſſary to ſhow

MECHANICS.

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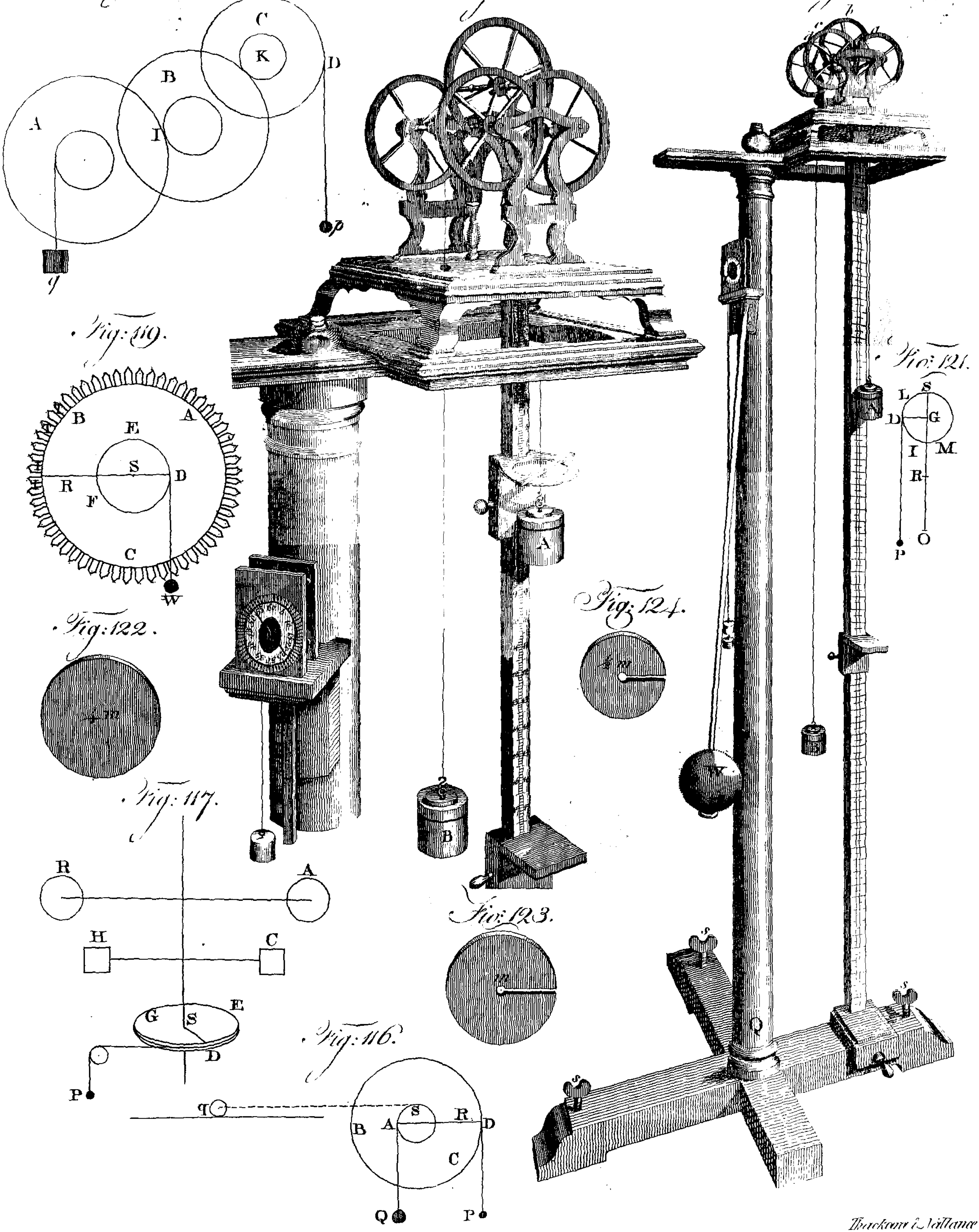

Fig: 118.

Fig: 125.

Fig: 120.

Fig: 119.

Fig: 121.

Fig: 124.

Fig: 122.

Fig: 117.

Fig: 123.

Fig: 116.

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in what manner the motion of bodies reſiſted by conſtant forces are reduced to experiment by means of the inſtrument above deſcribed, with as great eaſe and preciſion as the properties of bodies uniformly accelerated. A ſingle inſtance will be ſufficient: Thus, ſuppoſe the maſs contained in the weights A and B, fig. 125. and the wheels to be 61 *m*, when perfectly in equilibrio; let a circular weight *m* be applied to B, and let two long weights or rods, each = *m*, be applied to A, then will A deſcend by the action of the moving force *m*, the maſs moved being 64 *m*: ſuppoſe that when it has deſcribed any given ſpace by conſtant acceleration, the two rods *m* are intercepted by the circular frame above deſcribed, while A is deſcending through it, the velocity acquired by that deſcent is known; and when the two rods are intercepted, the weight A will begin to move on which the velocity acquired, being now retarded by the conſtant force *m*; and ſince the maſs moved is 62 *m*, it follows, that the force of retardation will be $\frac{1}{62}$ part of that force whereby gravity retards bodies thrown perpendicularly upwards. The weight A will therefore proceed along the graduated ſcale in its deſcent with an uniformly retarded motion, and the ſpaces deſcribed, times of motion, and velocities deſtroyed by the reſiſting force, will be ſubject to the ſame meaſures as in the examples of accelerated motion above deſcribed.

In the foregoing deſcriptions, two ſuppoſitions have been aſſumed, neither of which are mathematically true: but it may be eaſily ſhown that they are ſo in a phyſical ſenſe; the errors occaſioned by them in practice being inſenſible.

1. The force which communicates motion to the ſyſtem has been aſſumed conſtant; which will be true only on a ſuppoſition that the line, at the extremities of which the weights A and B, fig. 120. are affixed, is without weight. In order to make it evident, that the line's weight and inertia are of no ſenſible effect, let a caſe be referred to, wherein the body A deſcends through 48 inches from reſt by the action of the moving force *m*, when the maſs moved is 64 *m*; the time wherein A deſcribes 48 inches is increaſed by the effects of the line's weight by no more than $\frac{312}{10000}$th parts of a ſecond; the time of deſcent being 3.9896 ſeconds, when the ſtring's weight is not conſidered, and the time when the ſtring's weight is taken into account = 4.0208 ſeconds; the difference between which is wholly inſenſible by obſervation.

2. The bodies have alſo been ſuppoſed to move in vacuo, whereas the air's reſiſtance will have ſome effect in retarding their motion: but as the greateſt velocity, communicated in theſe experiments, cannot much exceed that of about 26 inches in a ſecond (ſuppoſe the limit 26.2845), and the cylindrical boxes being about 1$\frac{3}{4}$ inches in diameter, the air's reſiſtance can never increaſe the time of deſcent in ſo great a proportion as that of 240 : 241; its effect therefore will be inſenſible in experiment.

The effects of friction are almoſt wholly removed by the friction wheels; for when the ſurfaces are well poliſhed and free from duſt, &c. if the weights A and B be balanced in perfect equilibrio, and the whole maſs conſiſts of 63 *m*, according to the example already deſcribed, a weight of 1$\frac{1}{2}$ grains, or at moſt 2 grains, being added either to A or B, will communicate motion to the whole; which ſhows that the effects of friction will not be ſo great as a weight of 1$\frac{1}{2}$ or 2 grains. In ſome caſes, however, eſpecially in experiments relating to retarded motion, the effects of friction become ſenſible; but may be very readily and exactly removed by adding a ſmall weight 1.5 or 2 grains to the deſcending body, taking care that the weight added is ſuch as is in the leaſt degree ſmaller than that which is juſt ſufficient to ſet the whole in motion, when A and B are equal and balance each other before the moving force is applied.

MECHOACAN, a province of Mexico, or New Spain, in America, bounded on the north by Panuco and Gaudalajara, on the eaſt by Panuco and Mexico Proper, on the ſouth by the Pacific Ocean, and on the weſt by Guadalajara and the South Sea. The ſoil is exceedingly fertile; and the climate ſo wholeſome, that the Spaniards imagine it to be poſſeſſed of ſome peculiarly reſtorative quality; for which reaſon the ſick and infirm flock to it from all quarters. The commodities are ſulphur, indigo, ſarſaparilla, ſaſſafras, cacao, vanelloes, ambergriſe, hides, wool, cotton, ſilk, ſugar, the root mechoacan or white jalap, and ſilver. This province formed an independent kingdom at the time Mexico was reduced by Cortez. The ſovereign had long been the inveterate enemy of the Mexicans, and was conſidered, next to the republic of Tlaſcala, as the moſt formidable barrier againſt the extenſion of the imperial frontier. However, he ſubmitted to Cortez without ſtriking a blow, being intimidated by the wonders he had performed with a handful of men; and thus Mechoacan became a province of the Spaniſh empire, and a valuable addition to Mexico. The country at that time was exceedingly populous, but the natives are now much thinned; and that rather by the luxury and effeminacy introduced by the Spaniards, than by their tyranny. The capital of the province is alſo called *Mechoacan* by the natives, but *Valladolid* by the Spaniards.

MECHOACAN, or *White Jalap*, in the materia medica, the root of an American ſpecies of convolvulus brought from Mechoacan, a province of Mexico, in thin ſlices like jalap, but larger, and of a whitiſh colour. It was firſt introduced into Europe about the year 1524, as a purgative univerſally ſafe, and capable of evacuating all morbific humours from the moſt remote parts of the body: but as ſoon as jalap became known, mechoacan gradually loſt its reputation, which it has never ſince been able to retrieve. It is nevertheleſs by ſome ſtill deemed an uſeful cathartic; it has very little ſmell or taſte, and is not apt to offend the ſtomach; its operation is ſlow, but effectual and ſafe. Geoffroy affirms, that there is ſcarce any purgative accompanied with fewer inconveniences. It ſeems to differ from jalap only in being weaker; the reſins obtained from both have nearly the ſame qualities, but jalap yields five or ſix times as much as mechoacan; hence it is found neceſſary to exhibit the latter in ſix times the doſe of the former to produce the ſame effects.

MECKLENBURG, a duchy of Germany, containing thoſe of Schwerin and Guſtro, is bounded by Pomerania on the eaſt, by part of the marquiſate of Brandenburg and the duchy of Lunenburg on the ſouth, the Baltic on the north, and Holſtein and Saxe-Lawenburg on the weſt. Their greateſt length is about 120 miles, and greateſt breadth upwards of 60. With reſpect to the ſoil, much cannot be ſaid in favour of it, as it conſiſts in general, either of ſand, or large and deſolate heaths, interſperſed with moors, woods, fens, and lakes. It yields very little wheat, and not a great deal of oats, rye, and barley; but breeds a conſiderable number of ſheep and cattle, has plenty of fiſh, with ſtone quarries, ſalt-ſprings, alum, iron, and ſome copper. The principal rivers here are the Elde and Stor, which fall into the Elbe as it glides along the borders of this country to the ſouth-weſt; the Reckenitz, which diſcharges itſelf into the Baltic; as do the Peene, the Warno, and the Stopenitz. This country has only one harbour on the Baltic, namely that of Roſtock. In both duchies, excluſive of Roſtock, are 45 great and ſmall cities, with three convents, and a great number of manors and farms, belonging either to the duke, the nobility, or convents. The peaſants are in a ſtate of villainage; but the nobility enjoy very conſiderable privileges. The ſtates are compoſed of the nobility and towns; and the diets, which are ſummoned annually, are held alternately at Sternberg and Malehin. The duchy of Schwerin appoints four provincial counſellors, and that of Guſtro as many; who rank according to ſeniority with the duke's actual privy-counſellors as their marſhals do with the colonels. The leſſer committee repreſents the whole body of the nobility and commons, by whom the members are choſen freely and without controul, and no edict relative to the whole country can be publiſhed without their conſent, or in prejudice of their rights. The inhabitants of this country are moſtly Lutherans, under their ſuperintendants. There are alſo ſome Calviniſts and Roman Catholics. Beſides the grammar-ſchools in the towns, there is an univerſity at Roſtock. The commodities of the duchy are corn, flax, hemp, hops, wax, honey, cattle, butter, cheeſe, wool, and wood, a part of which is exported, but hardly any manufactures.

Of the houſe of Mecklenburg, there are two lines ſtill ſubſiſting, viz. that of Schwerin and that of Strelitz. The latter commenced in duke Adolphus Frederick II. younger brother of the duke of Schwerin, and grandfather of the preſent duke of Strelitz, Adolphus Frederick IV. who entered on the government in 1752, and whoſe family hath lately received a great additional luſtre by his Britannic majeſty's taking his ſecond ſiſter for his conſort, and by her own great merit and noble deportment in that high ſtation. Beſides the duchy of Strelitz, to this duke belong the principality of Ratzeburg, with the lordſhip of Stargard, the ancient commanderies of Miro and Nemero, and a yearly penſion of 9000 dollars out of the Boitzenburgh toll. The title aſſumed by both the dukes is *duke of Mecklenburg, prince of Wenden, Schwerin, and Ratzburg, count of Schwerin and the country of Roſtock, and lord of Stargard.* By the agreement concluded at Wittſtock in 1442, the elector of Brandenburg, on the extinction of the male-line of the dukes of Mecklenburg, is intitled to their whole ſucceſſion. The duke of Schwerin has two votes both in the diet of the empire and that of the circle. The matricular aſſeſſment for the duchies of Schwerin and Guſtro is 40 horſe and 67 foot, or 748 florins monthly, including what is paid by Sweden for Wiſmar, and the bailiwics of Poll and Neukloſter. To the chamber of Wetzlar, theſe two duchies pay each 243 rix-dollars, 43 kruitzers. For the government of Mecklenburg, the adminiſtration of juſtice, and the management of the revenue, there is the privy council of regency, the demenſe-chamber, the high and provincial court of juſtice, to which appeals lie in moſt cauſes, both from the conſiſtory and the inferior civil courts, and which are common to both the dukes. As to the revenues, thoſe of the Schwerin line muſt be very conſiderable, thoſe ariſing from the demeſne-bailiwics and regalia alone amounting to 300,000 rix-dollars per annum. There is a tax on land that produces no contemptible ſum, and that called the *princeſs's tax* is fixed at 20,000 rix-dollars: beſides all theſe, there are alſo free-gifts. The whole revenues of the Strelitz branch are eſtimated at 120,000 rix dollars. Each of theſe princes maintains a body of troops.

MECONIUM, the excrement contained in the guts of an infant at its birth. If this matter is not ſoon purged off, it occaſions gripes, &c. A tea-ſpoonful of true caſtor oil is an excellent purge in this caſe: but the firſt milk from the mother's breaſt is uſually ſufficient, if it flows in due time.

MECONIUM, in pharmacy, the extract of Britiſh poppies. It has alſo the virtues of foreign opium, but in a ſomewhat lower degree.

END OF THE TENTH VOLUME.

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